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Kusano et al.

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(54) **IMAGE FORMING APPARATUS WITH SEPARATE SUPPORT MEMBERS FOR REMOVABLE CARTRIDGES**

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G03G 21/18 (2006.01)

(52) **U.S. Cl.**
CPC ***G03G 21/1661*** (2013.01); ***G03G 21/185*** (2013.01); *G03G 2221/1869* (2013.01)

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CPC G03G 21/1661; G03G 21/1619; G03G 21/1807; G03G 21/185; G03G 21/1853; G03G 2221/1603; G03G 2221/1869
USPC 399/110, 112, 111
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,848,329	A	12/1998	Aoyama et al.	
8,953,979	B2	2/2015	Mori et al.	
2001/0028811	A1*	10/2001	Kojima	G03G 21/185 399/111
2002/0044791	A1*	4/2002	Shinkai	G03G 21/1619 399/112
2003/0053819	A1*	3/2003	Nomura	G03G 15/0896 399/110
2010/0247143	A1*	9/2010	Tateishi	G03G 21/1853 399/112
2011/0026968	A1*	2/2011	Ishii	G03G 15/0168 399/111

FOREIGN PATENT DOCUMENTS

JP	10-78737 A	3/1998
JP	2012-145877 A	8/2012

* cited by examiner

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(57) **ABSTRACT**

An image forming apparatus, including: a plurality of image forming portions configured to form different color images; a first support member movable with respect to a main body of the image forming apparatus while supporting cartridges; and a second support member movable with respect to the main body independently of the first support member while supporting a cartridge other than the cartridges supported by the first support member, wherein the cartridges supported by the first and second support members are used in the different image forming portions, each of the first and second support members is movable between an inside position inside the main body and an outside position outside the main body, and each of the cartridges supported by the first and second support members is removably mountable in a state in which the corresponding support member is located in the outside position.

20 Claims, 20 Drawing Sheets

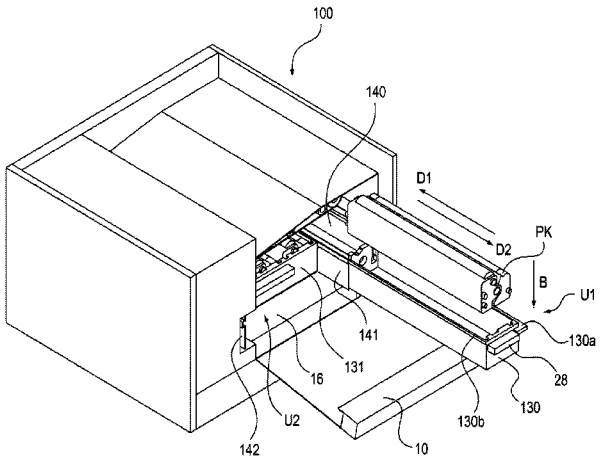
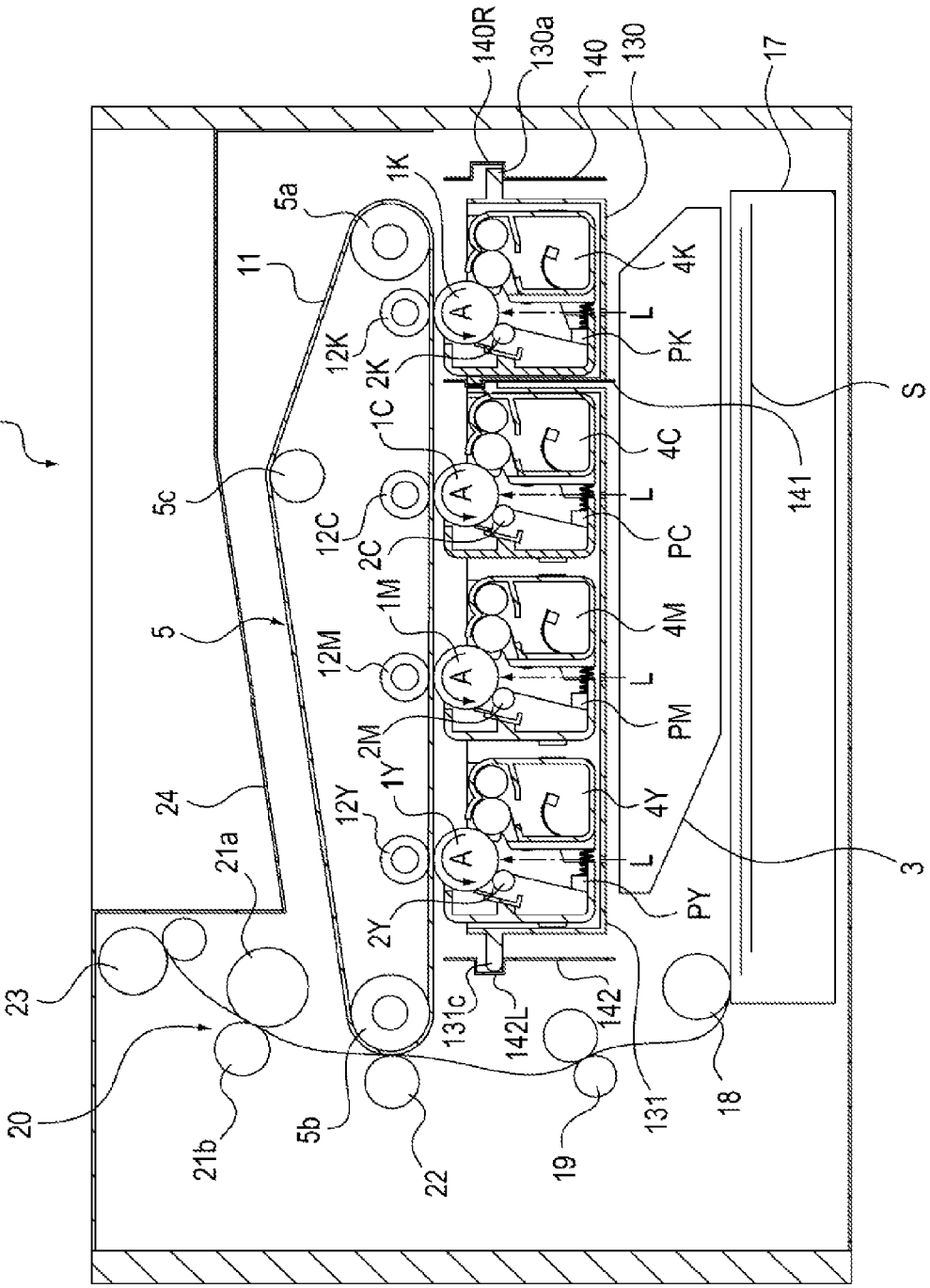


FIG. 1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2C
PC
141
1M
4M
5
12M
2M
PM
24
1Y
4Y
12Y
21a
3
2Y
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23
131c
142L
142
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21b
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19
131
18

FIG. 2

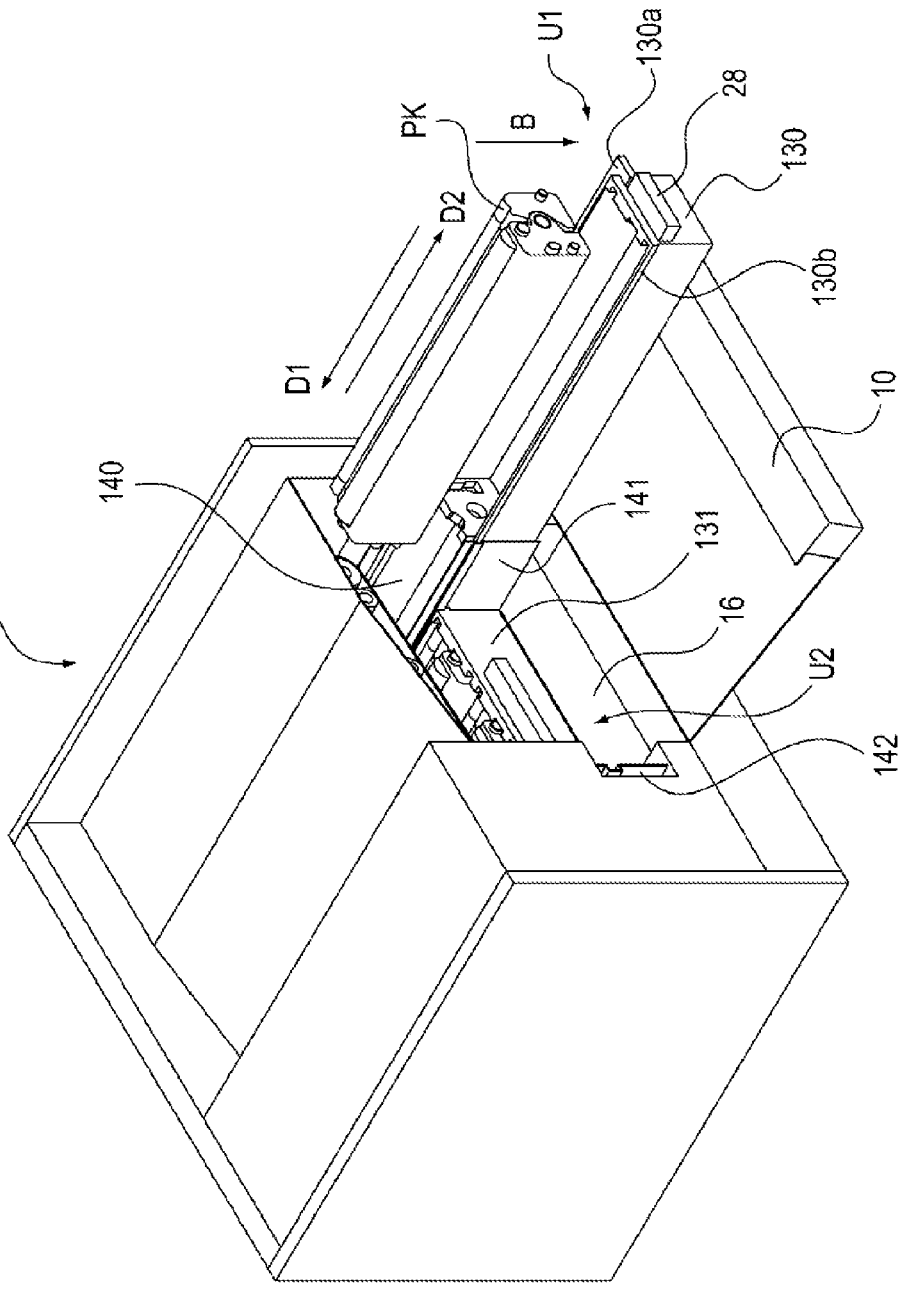


FIG. 3

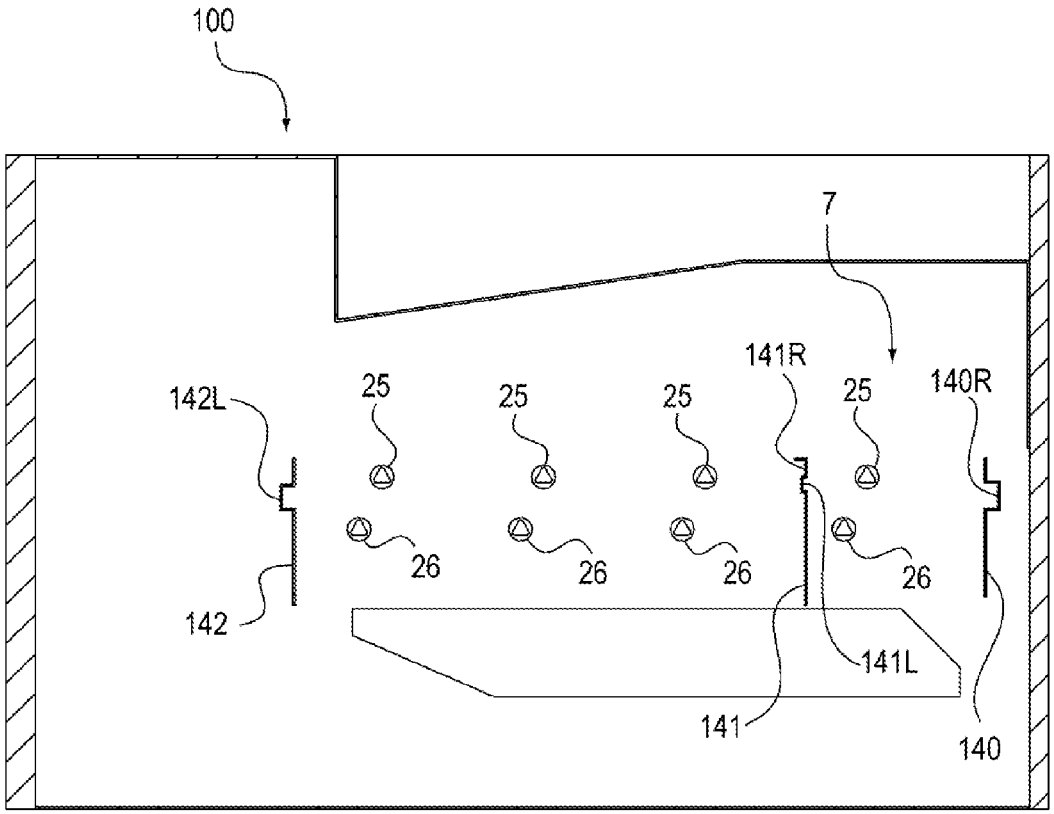
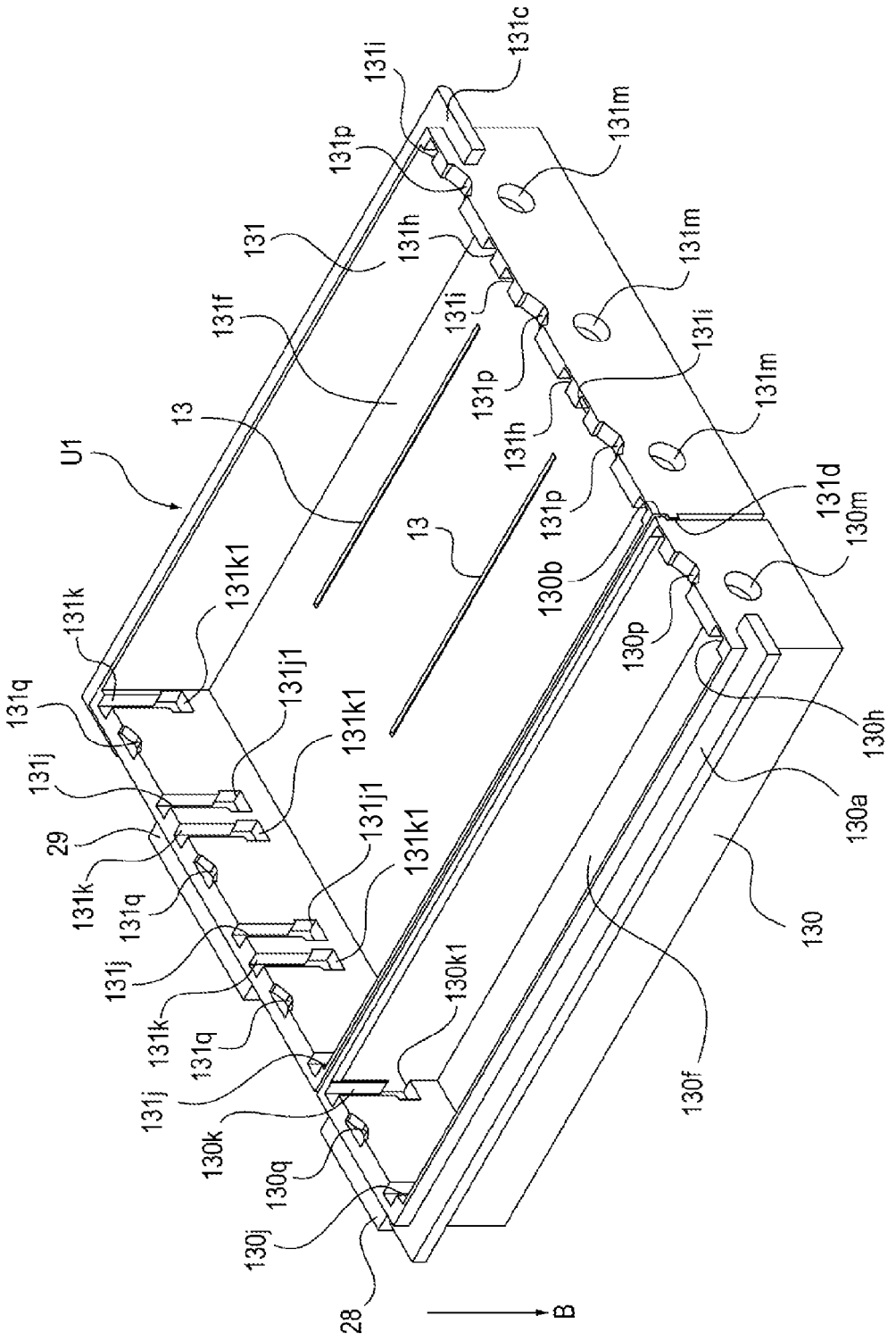


FIG. 4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131q
131j
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131q
131j
131k
131q
131j
130k
130q
130j
28
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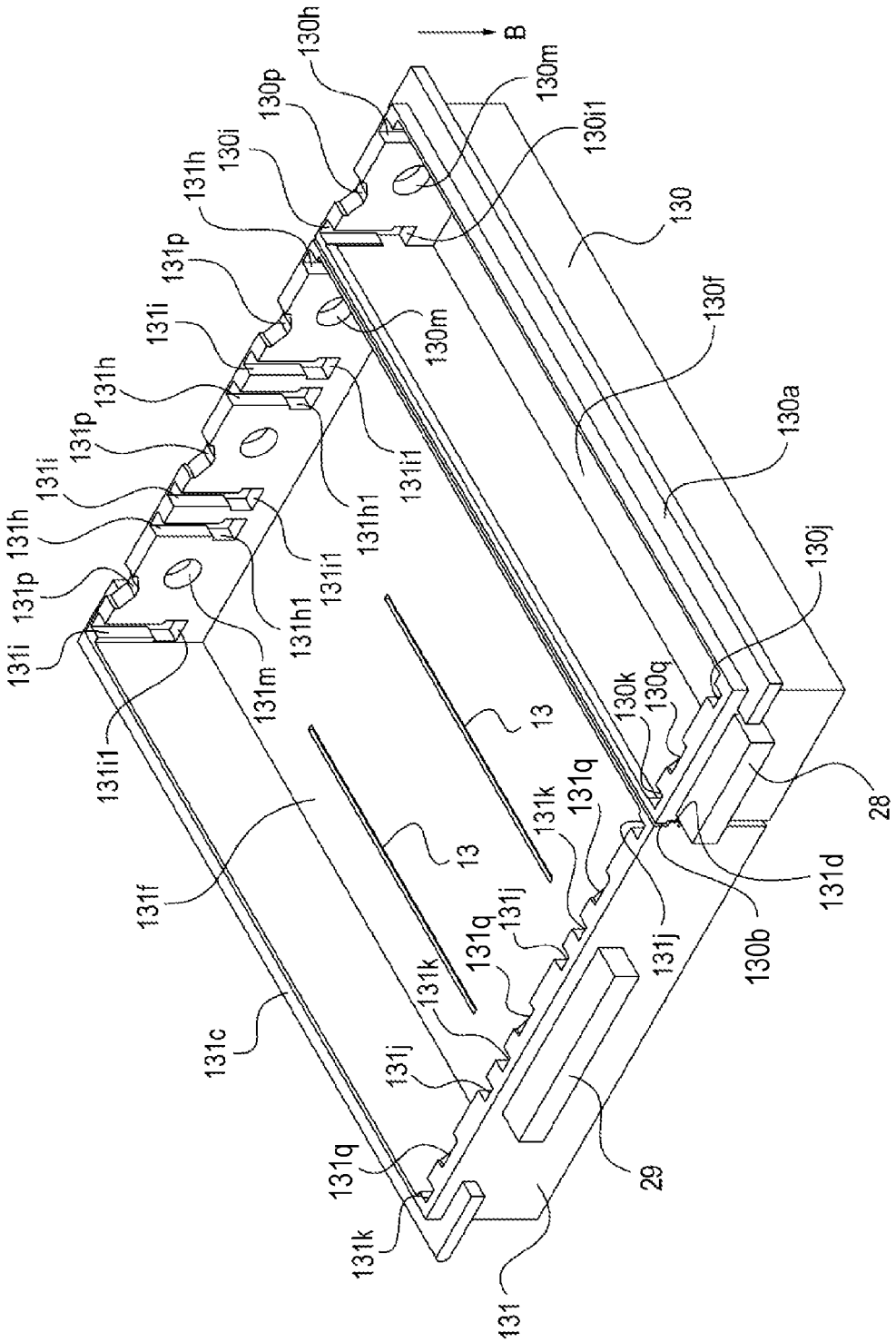
131j1
131k1
131j1
131k1
130k1
13
13
131f
131
131h
131p
131i
131c
131m
131m
131i
131m
131i
131p
131h
130b
131p
131d
130m
130p
130h
130a
130
130f
B

FIG. 5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131p
131i
131h
131p
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131h
131p
131i
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131i1
131m
131h1
131i1
131i1
131f
131c
131k
131q
131j
131k
131q
131j
131k
131q
131j
131q
131k
131
29
13
13
130m
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131q
131k
131j
131d
130b
28

FIG. 6

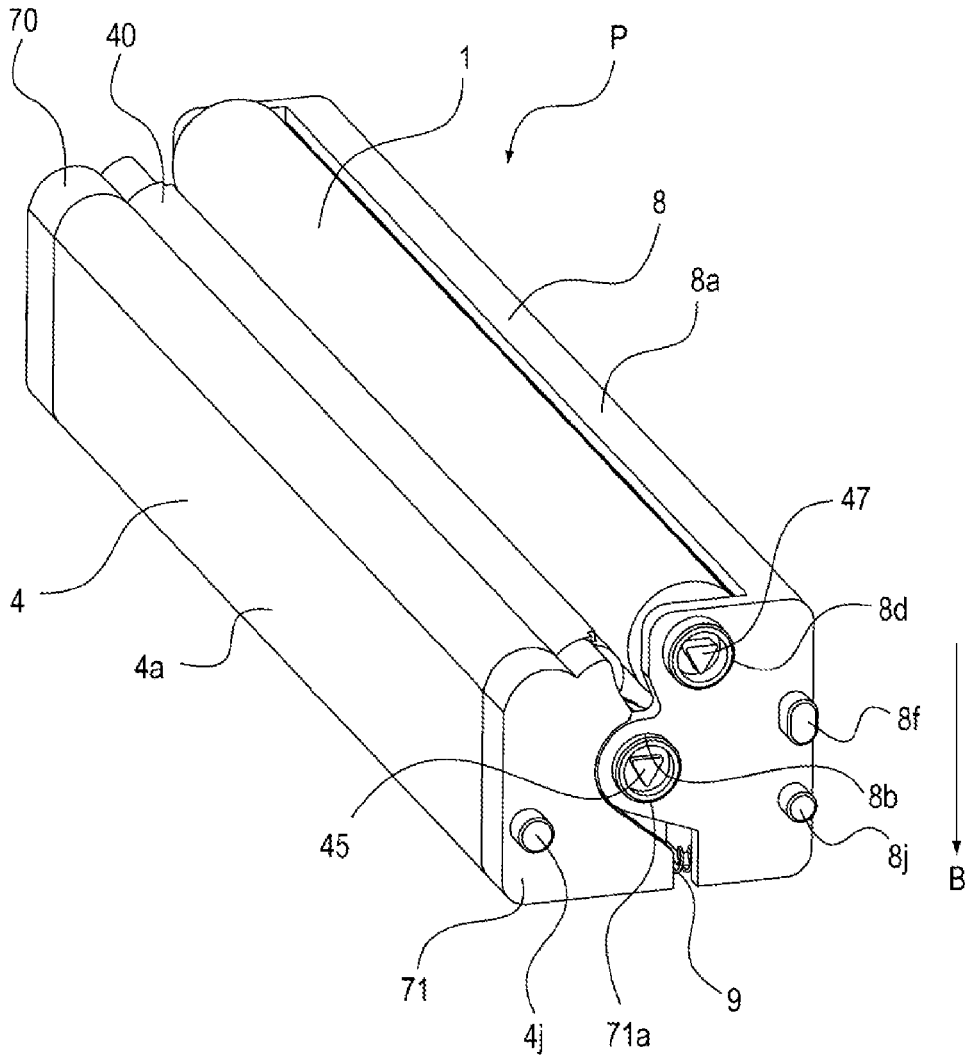


FIG. 7

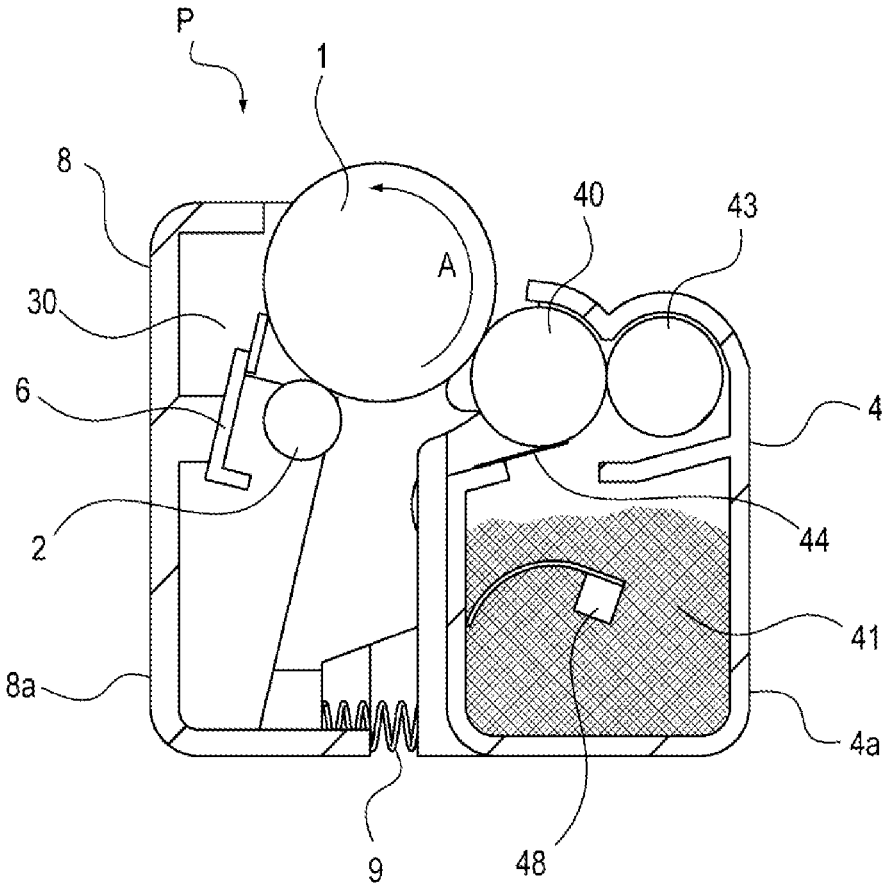
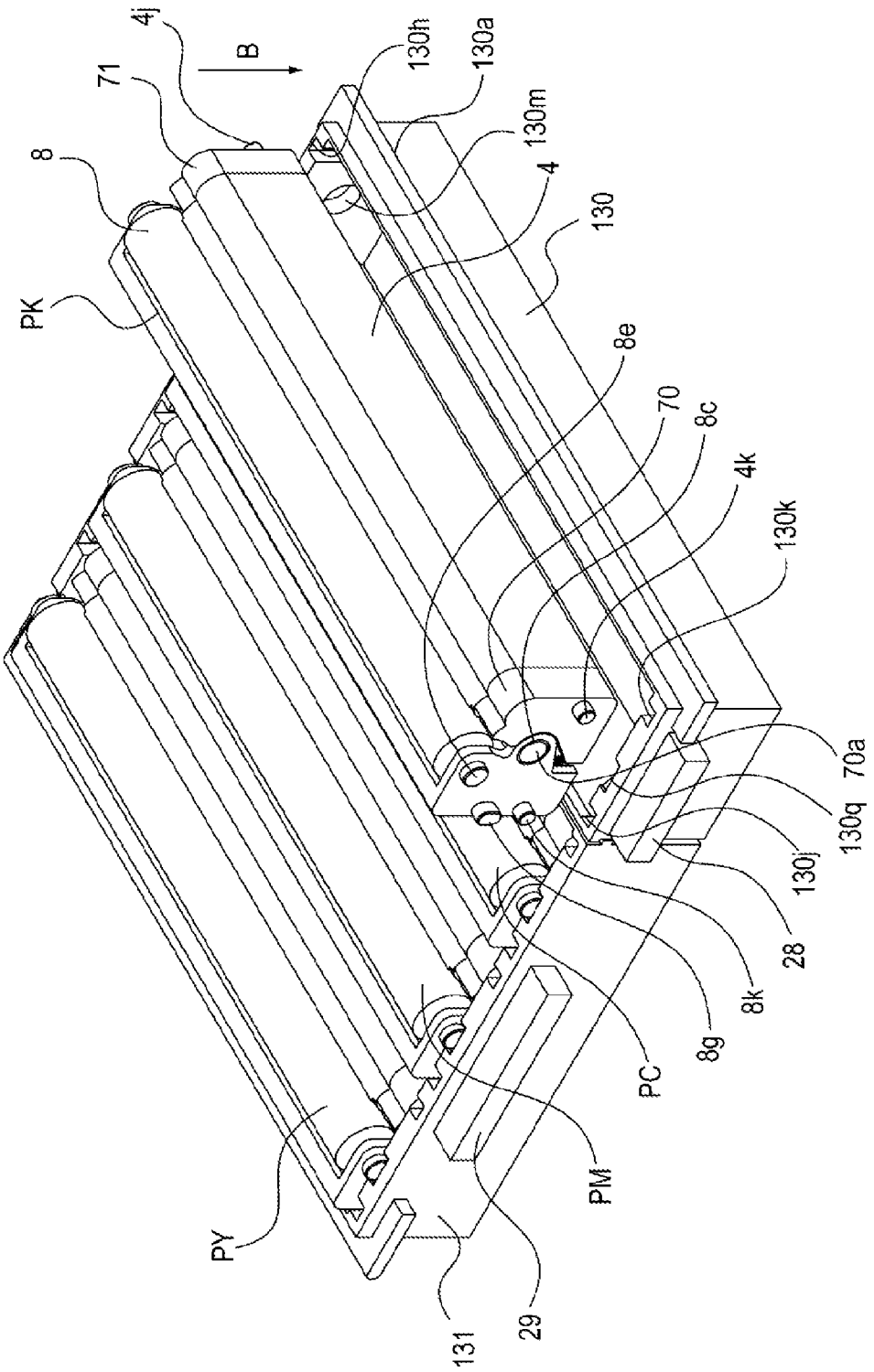


FIG. 8


4j
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4
130
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70a
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130j
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8g
PC
PM
PY
131
29

FIG. 9

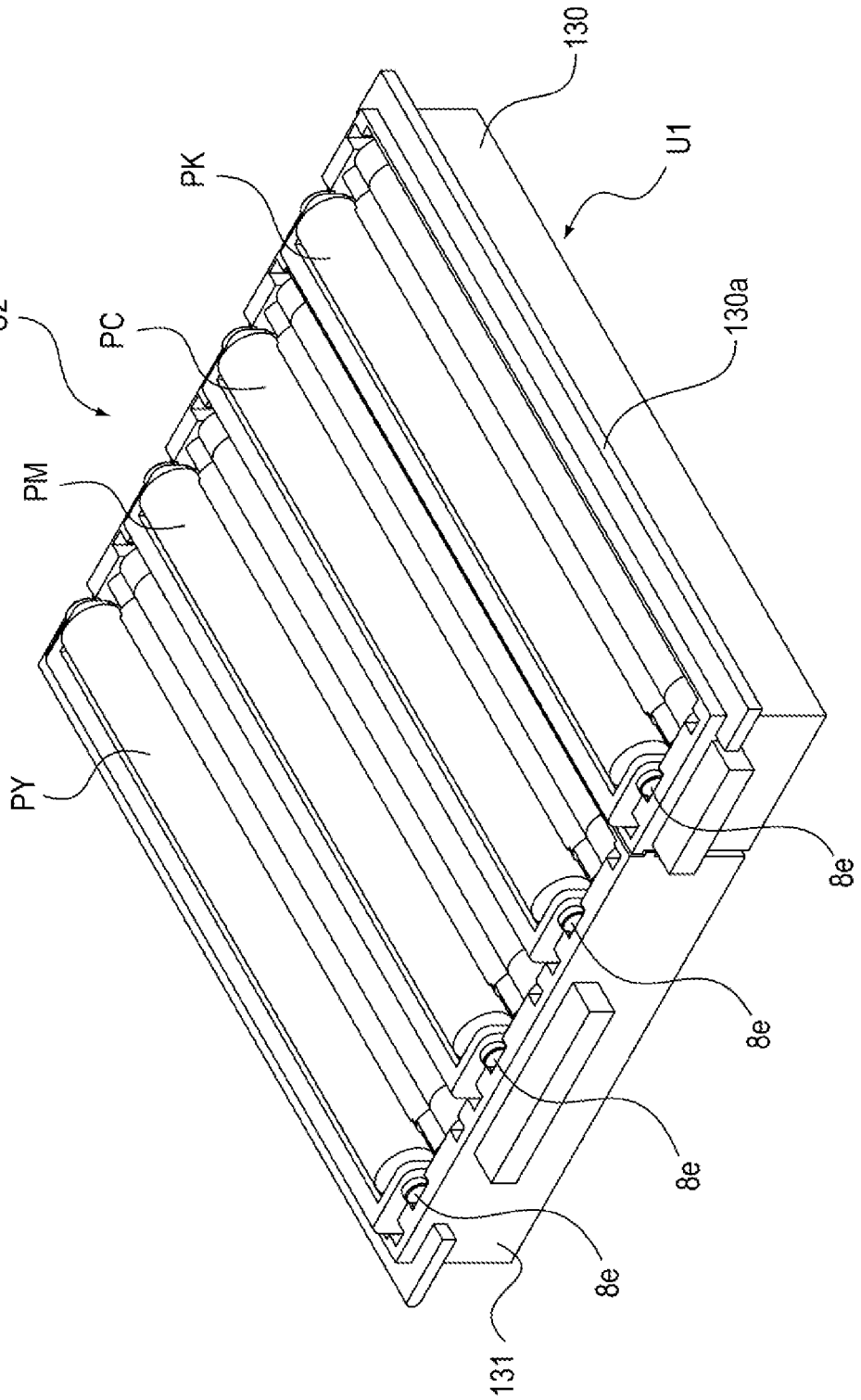


FIG. 10

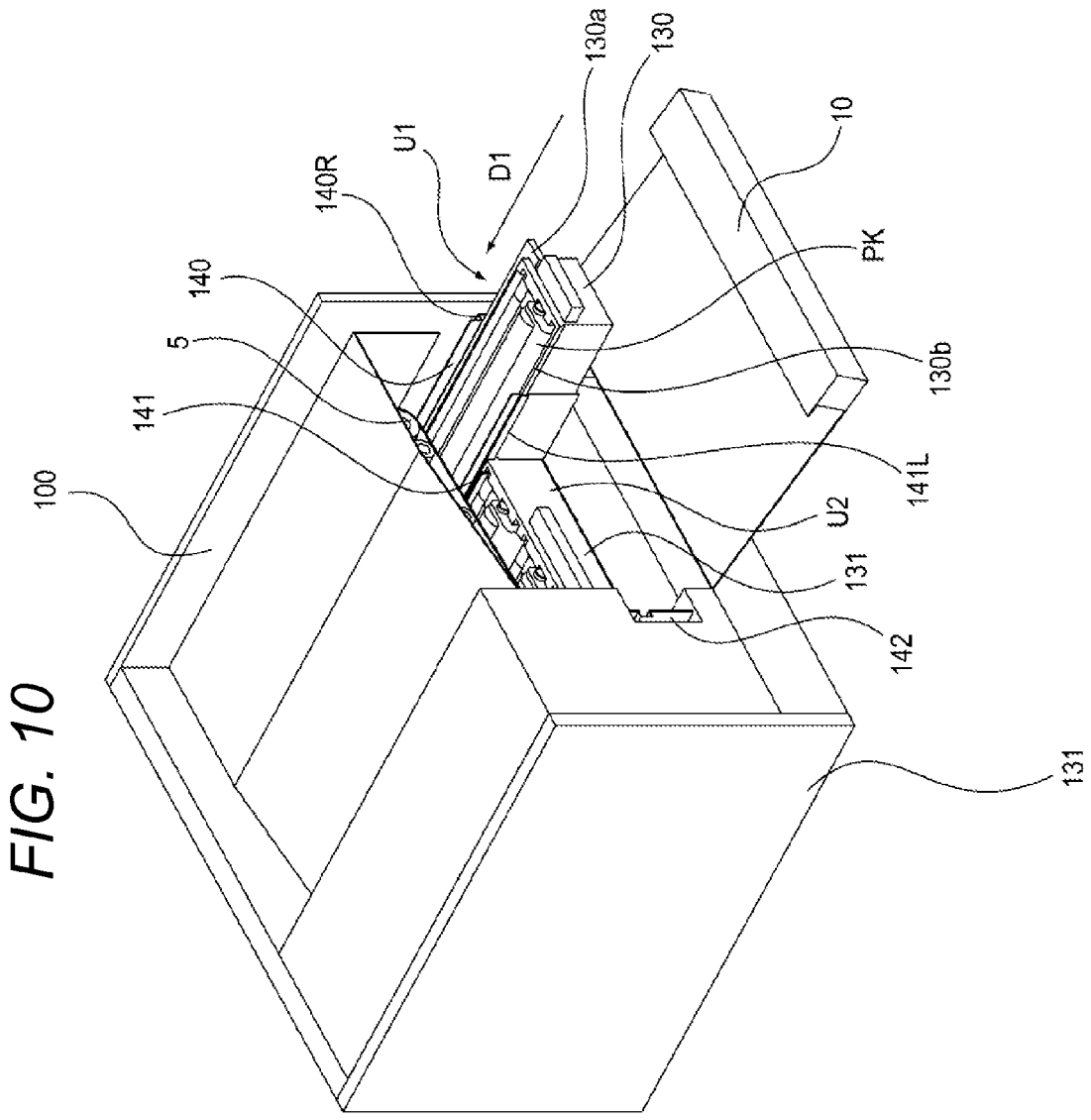
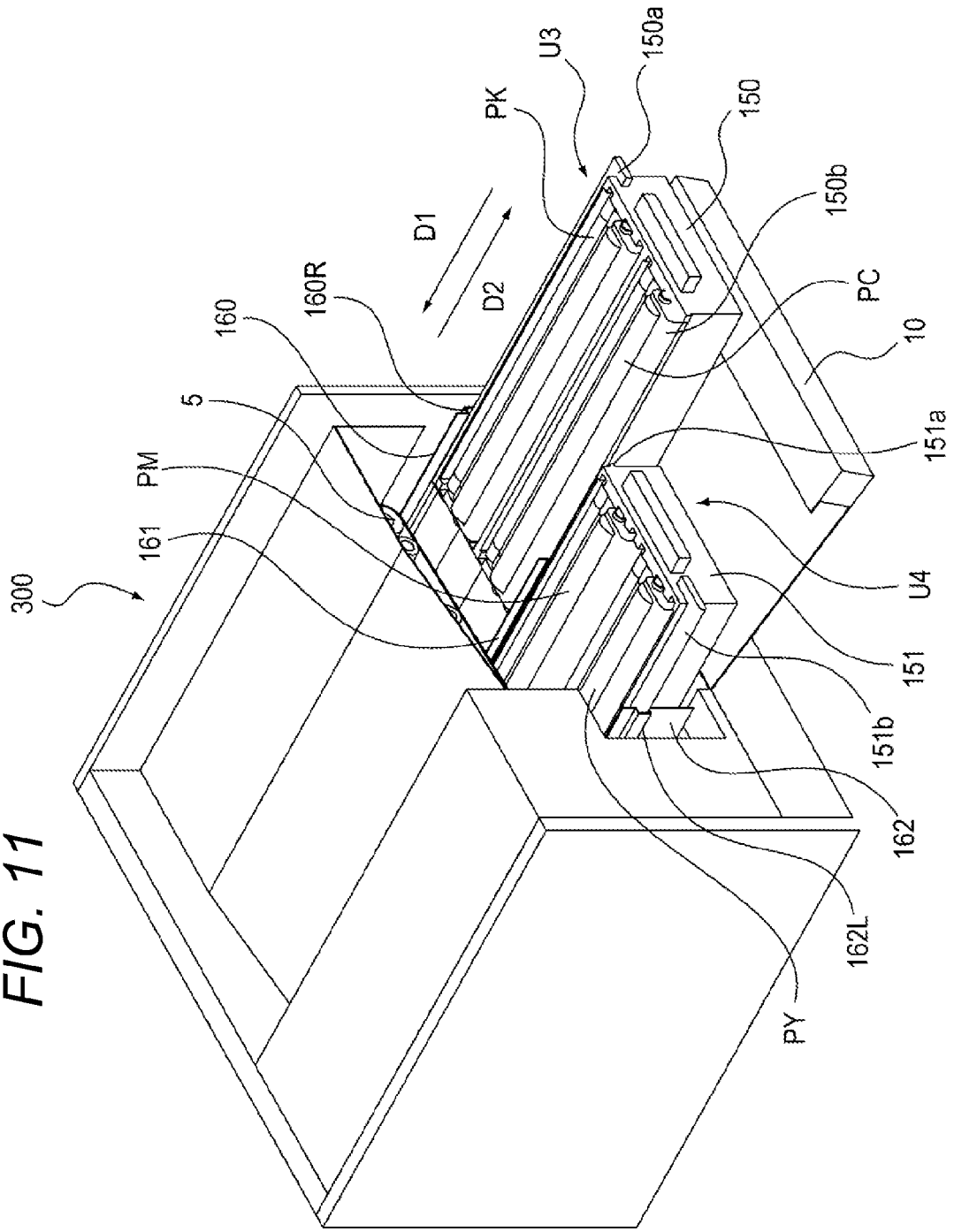


FIG. 11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U4
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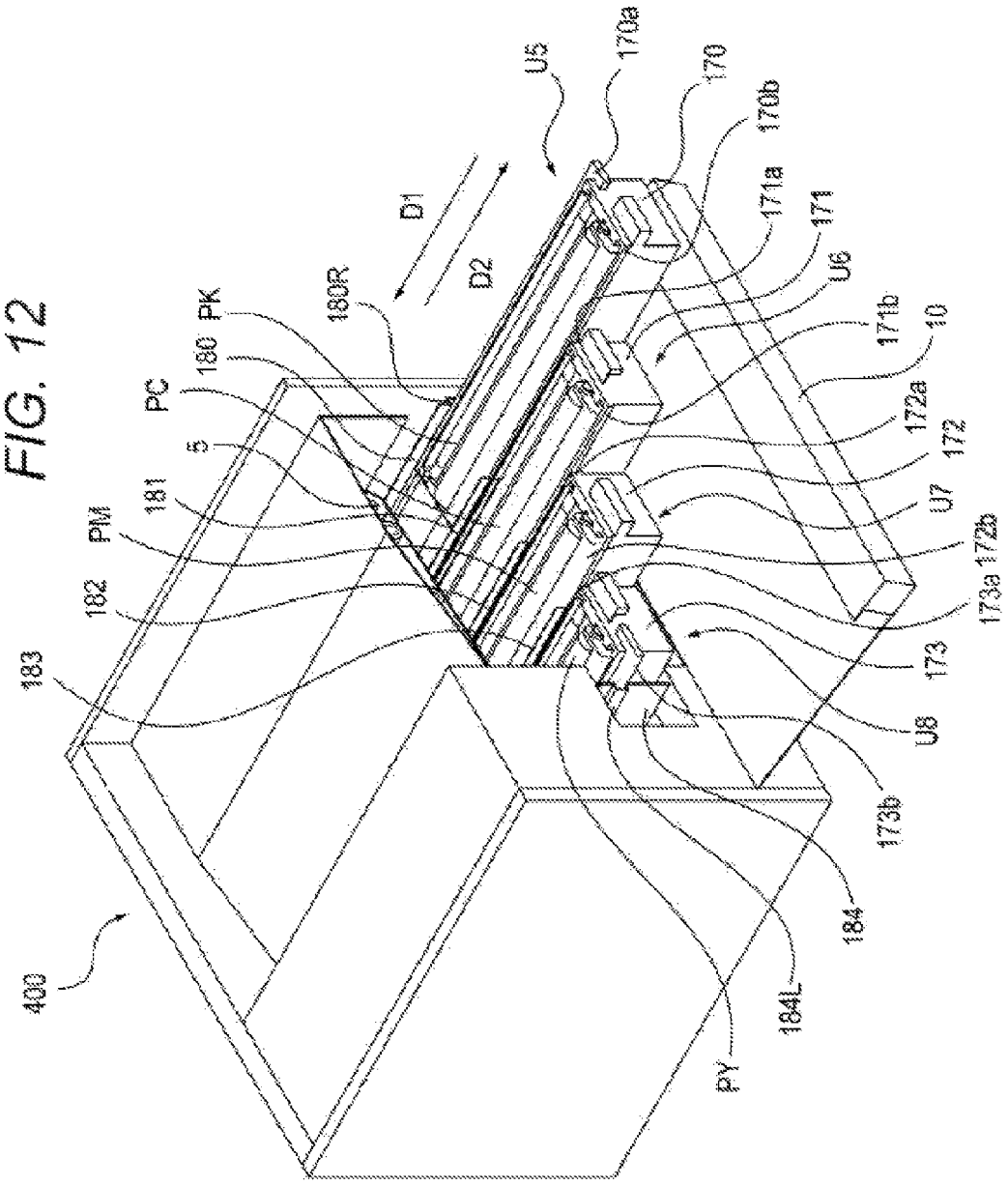
151b
162
162L
PY

FIG. 12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U6
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U7
172b
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U8
173b
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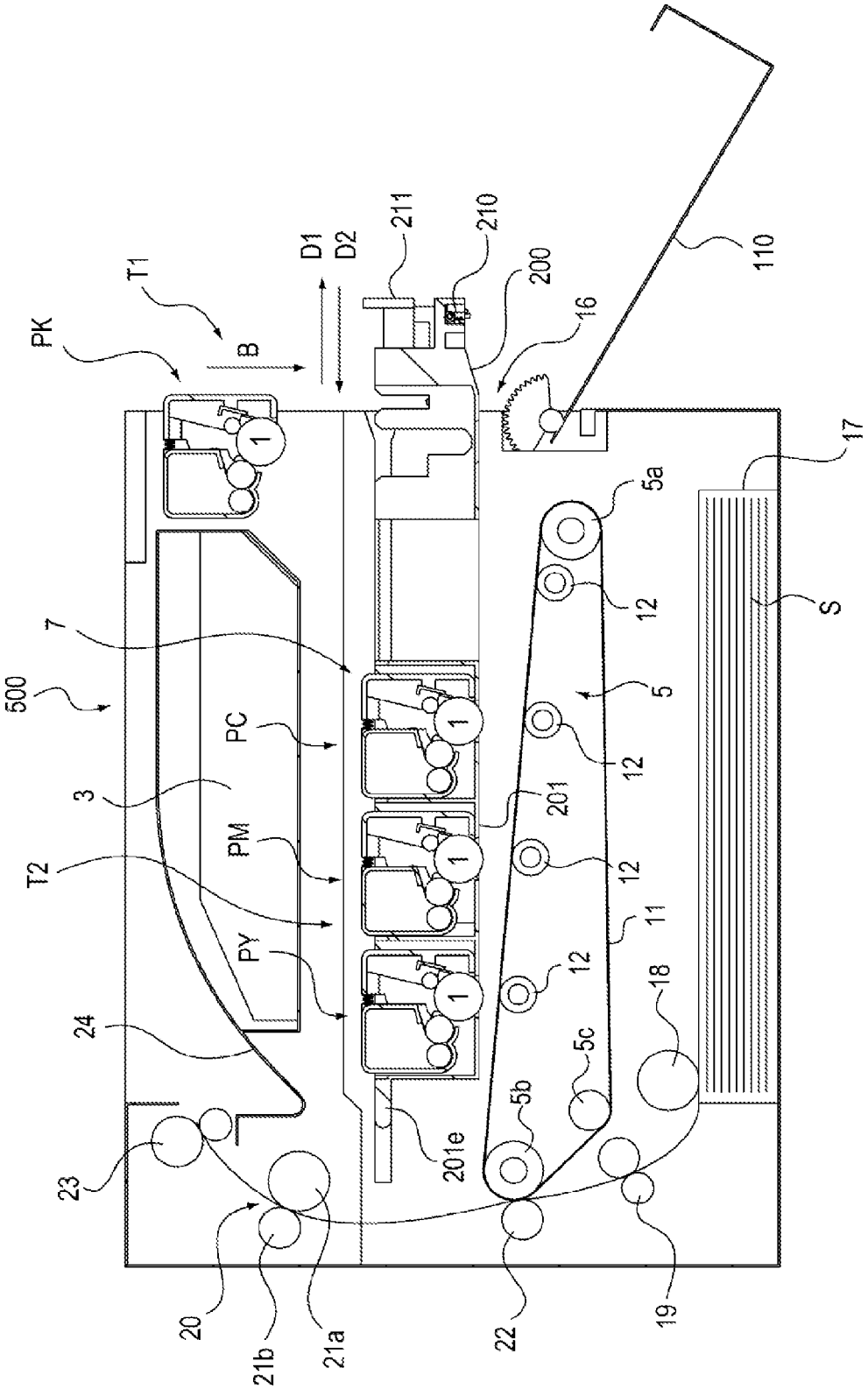
D1
D2

FIG. 13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12
S
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PC
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PM
T2
PY
201
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11
12
18
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5b
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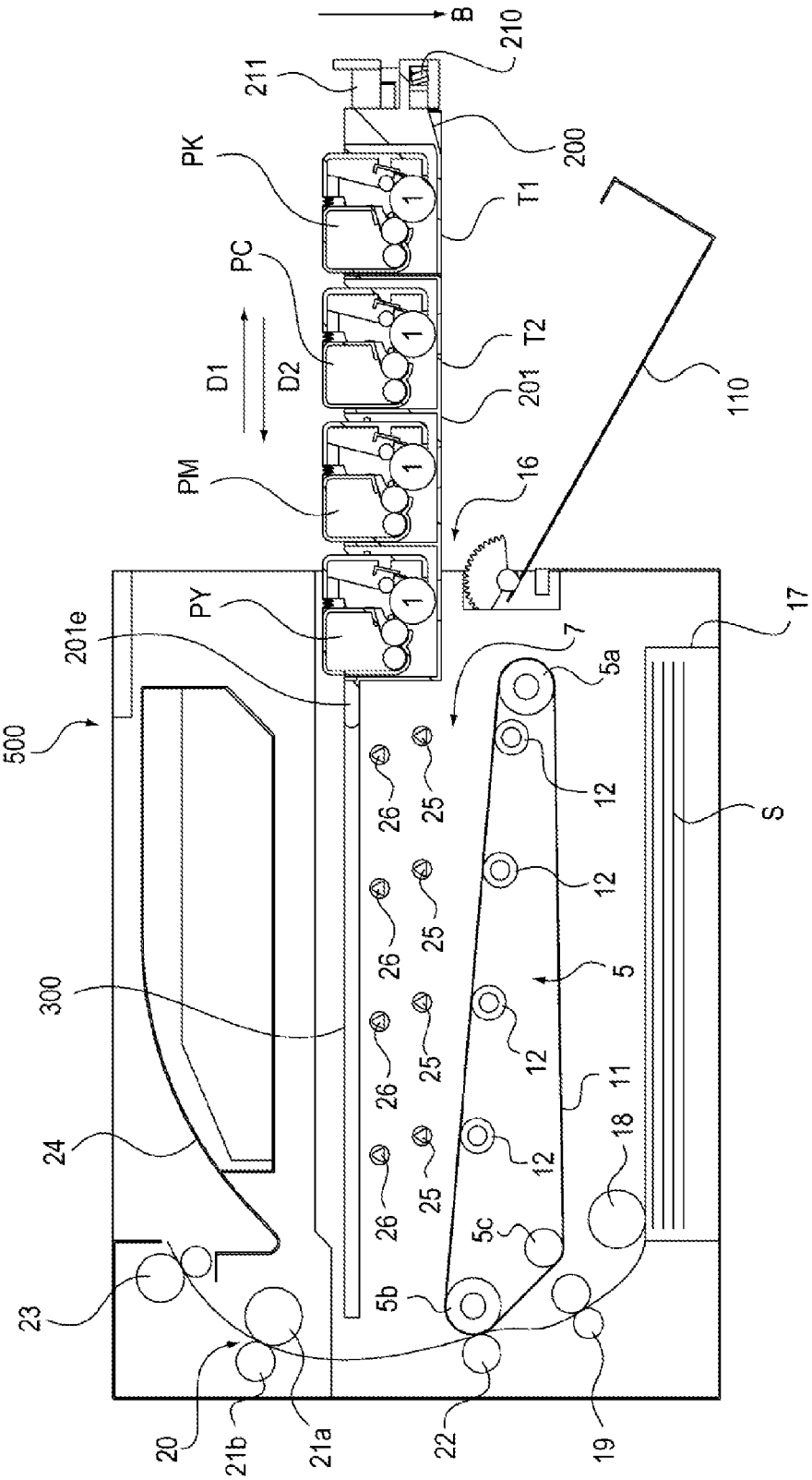
23
20
21b
21a
22
19

FIG. 14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D2
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21a
22
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FIG. 15

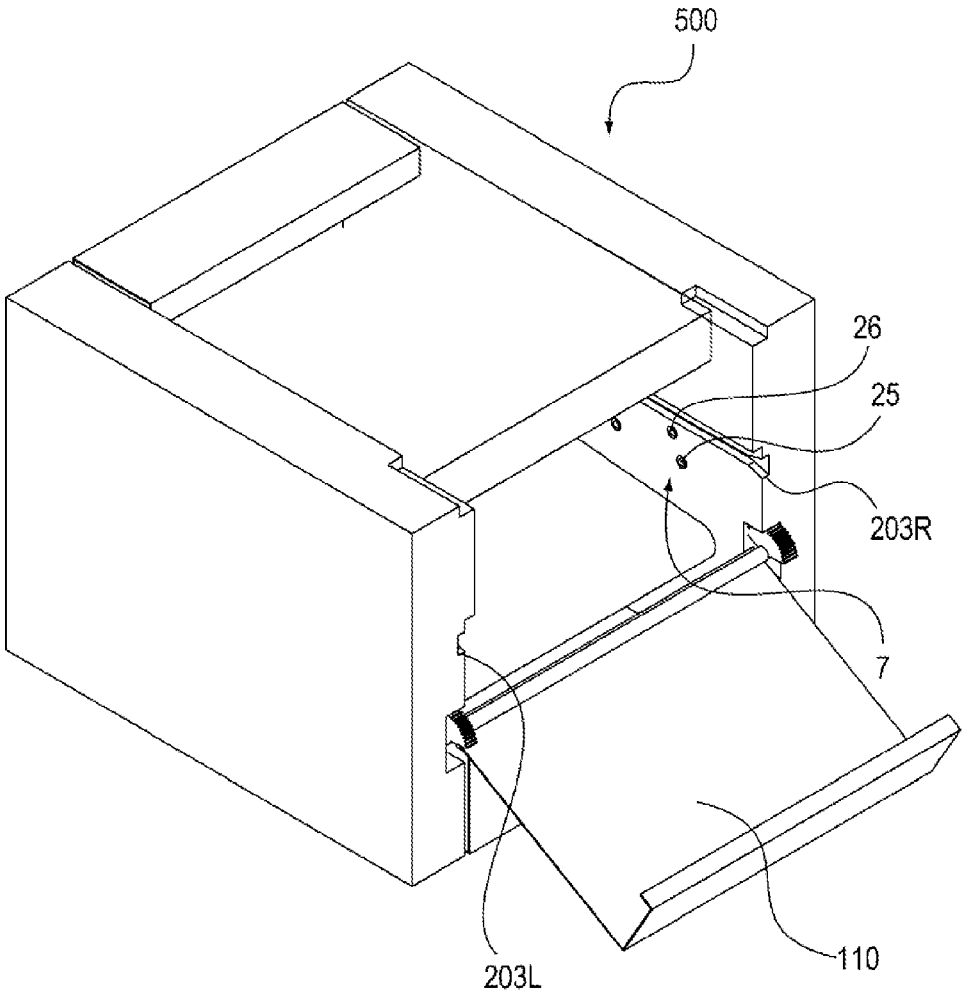
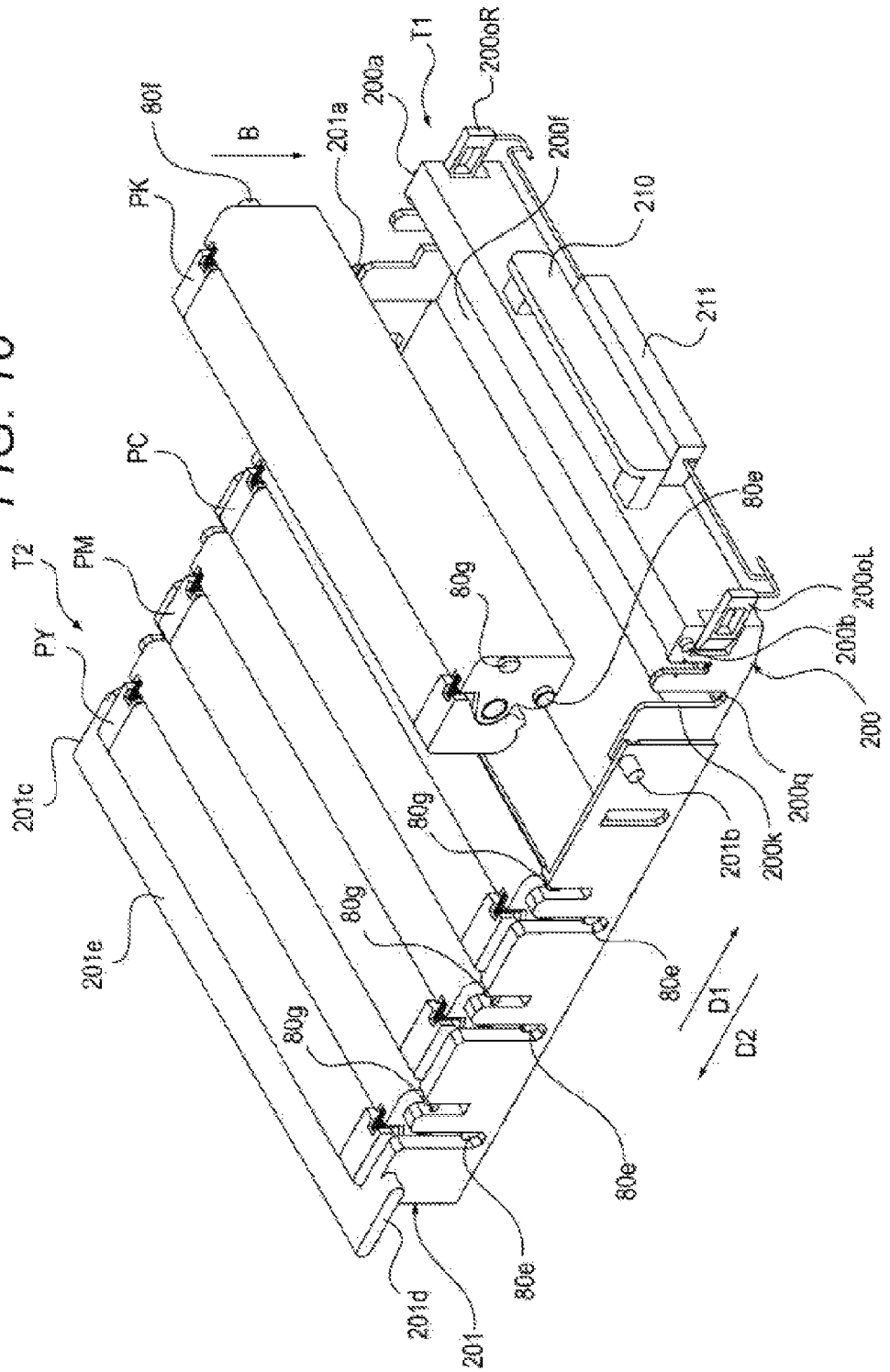


FIG. 16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200k
201b
201tc
201te
201d
201
D1
D2

FIG. 17

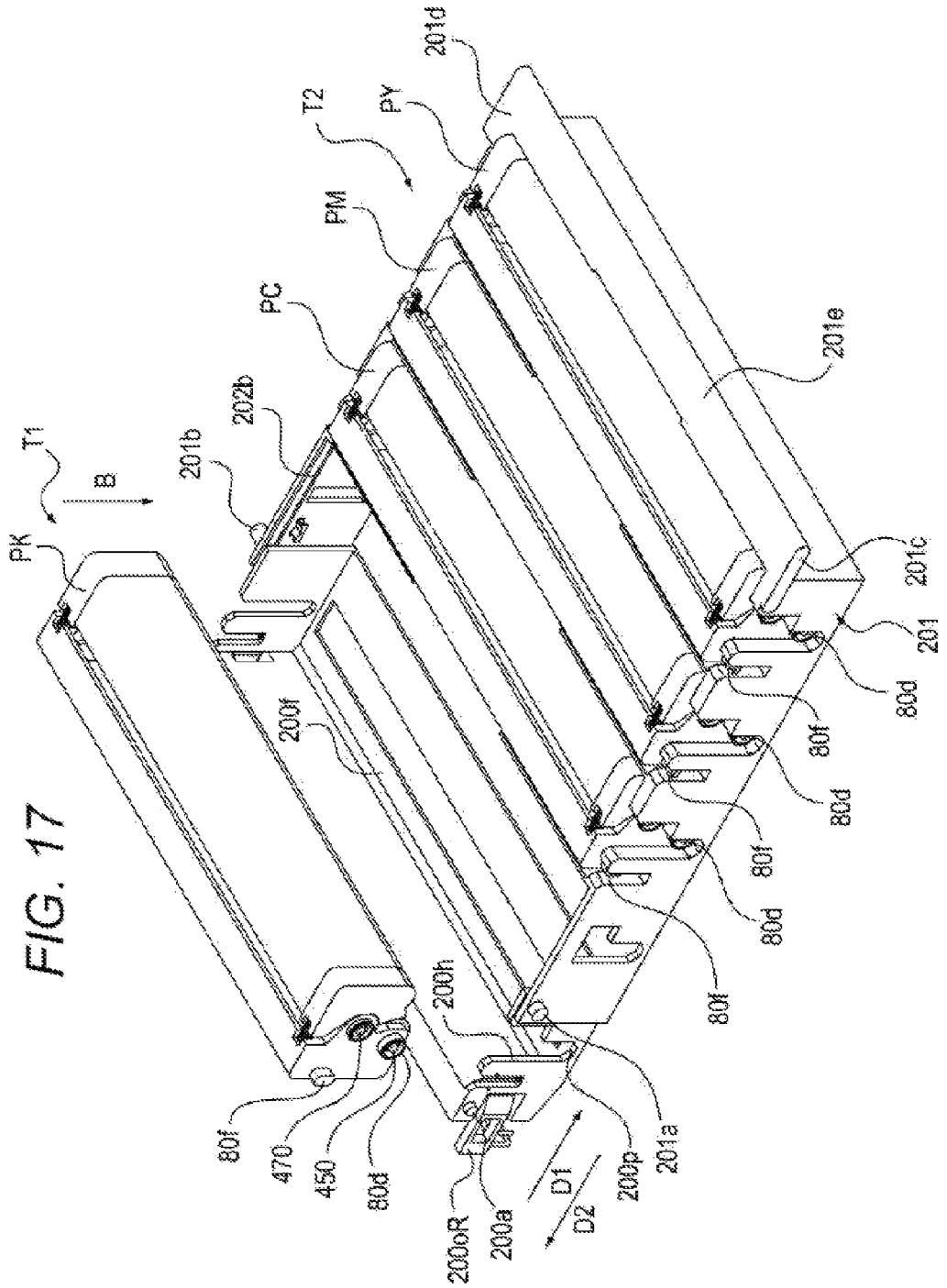
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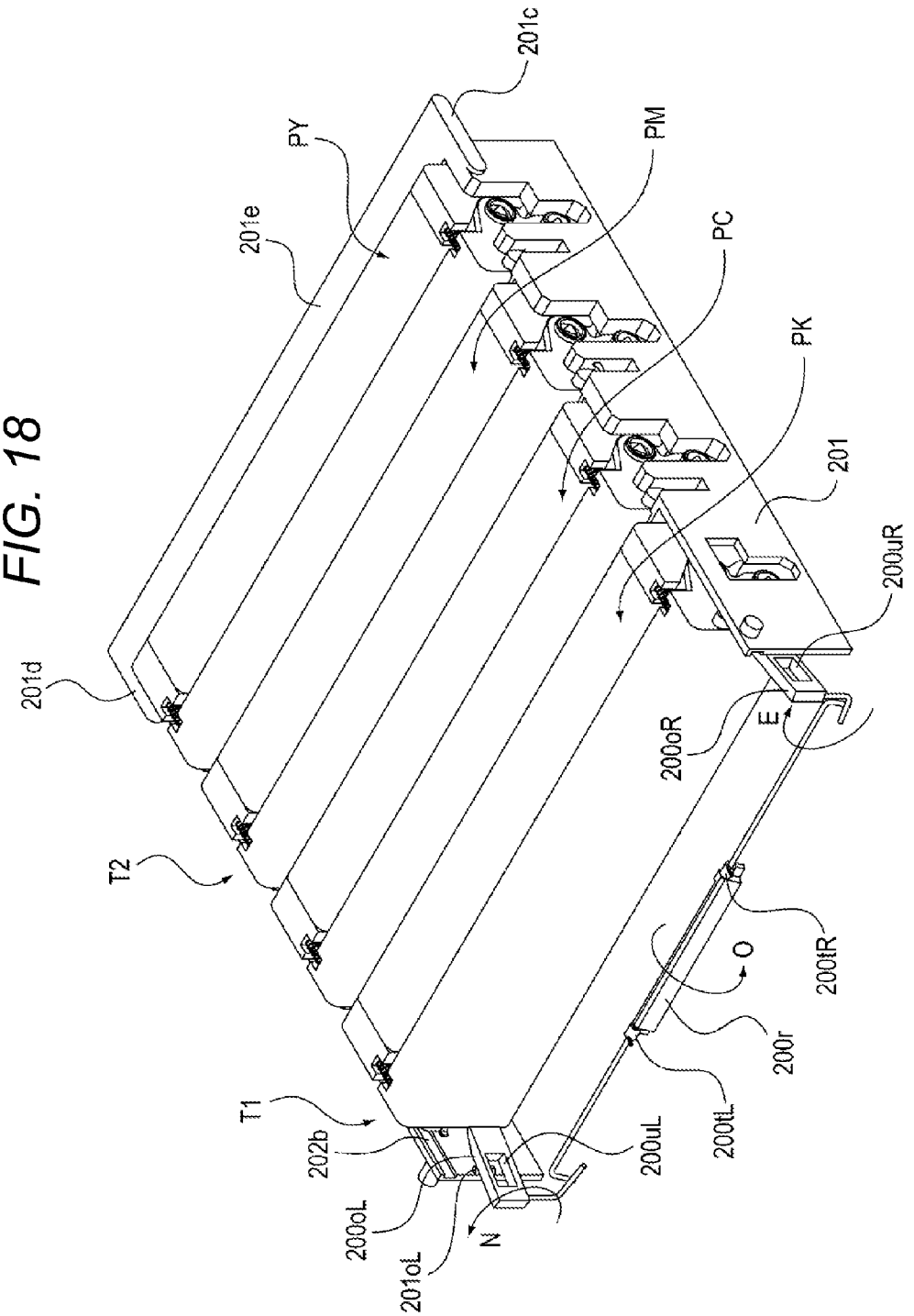
FIG. 18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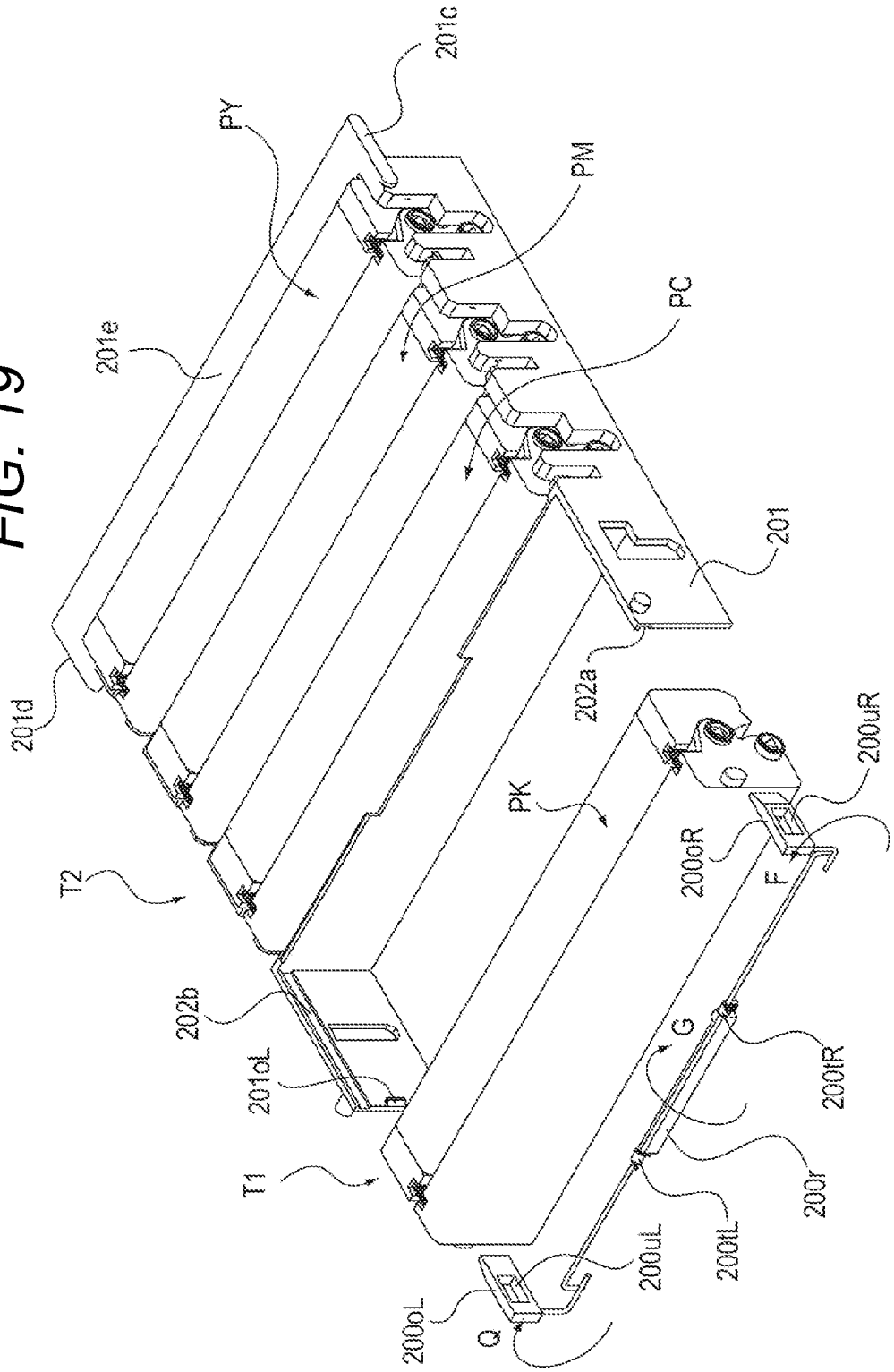
201oL

FIG. 19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200oL
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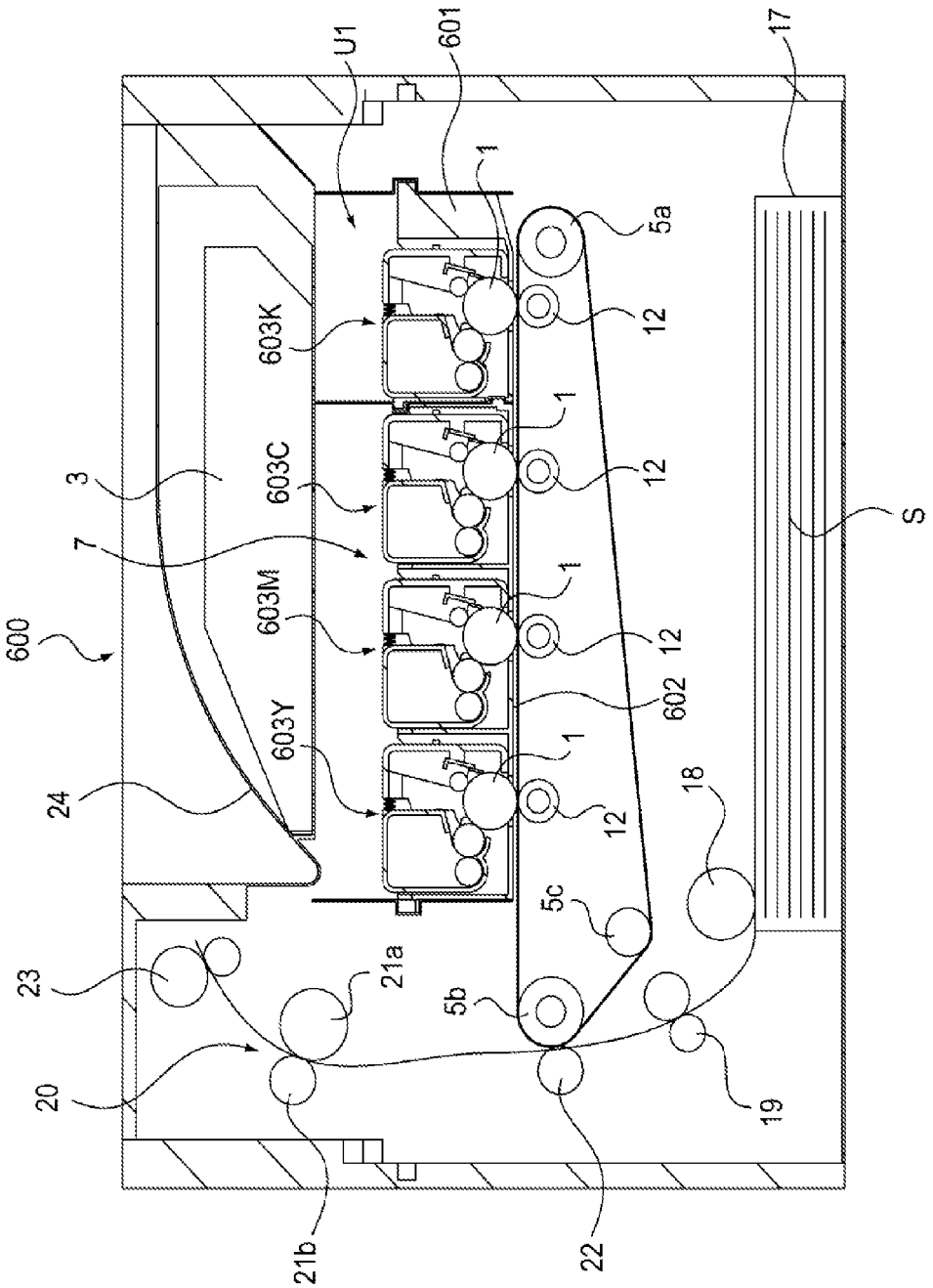
FIG. 20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603Y
12
24
18
5c
23
21a
5b
20
19
21b
22

IMAGE FORMING APPARATUS WITH SEPARATE SUPPORT MEMBERS FOR REMOVABLE CARTRIDGES

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an image forming apparatus using an electrophotographic image forming method.

An electrophotographic image forming apparatus uses the electrophotographic image forming method to form an image on a recording material. Examples of the electrophotographic image forming apparatus include an electrophotographic copying machine, an electrophotographic printer such as a light emitting diode (LED) printer and a laser beam printer, a facsimile machine, and a word processor.

2. Description of the Related Art

Hitherto, in an electrophotographic image forming apparatus using an electrophotographic image forming process (hereinafter referred to simply as "image forming apparatus"), there has been known a cartridge system. The cartridge system enables a cartridge to be mounted into and removed from a main body of the image forming apparatus so that components and consumable items used in the image forming apparatus are replaceable. Examples of the components to be replaced as the cartridge include an electrophotographic photosensitive drum (hereinafter referred to simply as "photosensitive drum") and a developing roller acting on the photosensitive drum. Further, the cartridge may also have a configuration in which a developer (toner) used for image formation is contained in the cartridge so that the developer is supplied to the main body through the replacement of the cartridge.

Those cartridge systems allow users themselves to perform maintenance of the image forming apparatus without service engineers. Thus, those cartridge systems have been widely used in image forming apparatus.

Further, there has also been known a configuration in which the cartridge is mountable into the main body in a state in which the cartridge is supported by a movable support member. For example, Japanese Patent Application Laid-Open No. H10-78737 discloses, in FIG. **1**, a configuration in which process units respectively including image bearing members (photosensitive drums) are mounted into the main body of the image forming apparatus while being guided by a guide rail through a slide rail. In the disclosed configuration, four process units are mountable into the main body and each of the process units is mountable into and removable from the main body separately and independently. Each of the process units is moved along an axis of the corresponding image bearing member (photosensitive drum) while being supported by the slide rail and the guide rail to be mounted into the main body.

Further, there has also been known a technology of providing a support member for loading a plurality of the cartridges to the image forming apparatus and pulling out the support member from inside the main body of the image forming apparatus to a predetermined position to enable replacement work to be performed for various types of cartridges. As an example of the technology, Japanese Patent Application Laid-Open No. 2012-145877 discloses a configuration in which the main body of the image forming apparatus includes two support members. Specifically, in the configuration disclosed in Japanese Patent Application Laid-Open No. 2012-145877, the support member for supporting the plurality of photosensitive member units including the photosensitive drums and the support member for supporting the plurality of developing cartridges are provided separately. As a result, the developing cartridges can be more easily replaced. In the configuration disclosed in Japanese Patent Application Laid-Open No. 2012-145877, the plurality of photosensitive member units for respectively forming images in different colors are supported by the same support member. Further, the plurality of developing cartridges for respectively forming images in different colors are supported by the same support member.

There is the following problem in a case where the plurality of cartridges (the plurality of photosensitive member units or the plurality of developing cartridges) for respectively forming the images in different colors are supported by the same support member to be mounted into the main body as in the case of the configuration disclosed in Japanese Patent Application Laid-Open No. 2012-145877.

Specifically, even when a cartridge for forming an image in a specific color is to be replaced, a user needs to move even a cartridge for forming an image in a color different from that of the cartridge, which is required to be replaced, out of the main body. Specifically, the user needs to pull the support member for supporting the plurality of cartridges out of the main body of the image forming apparatus.

In this case, if a weight of the support member that supports the plurality of cartridges increases along with an increase in capacity of the cartridges, there is a risk in that usability (ease of use) is impaired.

Therefore, a configuration, which allows the cartridge for the specific color alone to be pulled out of the main body for replacement, is preferred. In the case of the configuration in which the plurality of process units are separately and independently mounted into the main body as disclosed in Japanese Patent Application Laid-Open No. H10-78737, however, a plurality of the slide guides for supporting the processing units are required to be prepared for each of the processing units. As a result, the configuration of the image forming apparatus becomes complex.

Therefore, a configuration that improves the usability when the user pulls the support member for supporting the cartridge out of the main body of the image forming apparatus while keeping the simple configuration of the image forming apparatus is desired.

SUMMARY OF THE INVENTION

According to a representative embodiment of the present invention, there is disclosed an image forming apparatus, comprising:

a plurality of image forming portions configured to form images of colors different from one another;

a first support member movable with respect to a main body of the image forming apparatus in a state in which the first support member supports a plurality of cartridges; and

a second support member movable with respect to the main body independently of the first support member in a state in which the second support member supports a cartridge different from the plurality of cartridges supported by the first support member,

wherein the plurality of cartridges supported by the first support member and the cartridge supported by the second support member are used in the plurality of image forming portions different from one another, respectively,

each of the first support member and the second support member is movable between an inside position located inside of the main body and an outside position located outside of the main body, and

each of the plurality of cartridges supported by the first support member and the cartridge supported by the second support member is removably mountable in a state in which the first support member and the second support member are located in the outside position.

Further features of the present invention will become apparent from the following description of exemplary embodiments with reference to the attached drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a sectional explanatory view for illustrating a configuration of an image forming apparatus according to a first embodiment.

FIG. **2** is a perspective explanatory view for illustrating an operation of mounting support members into a main body of the image forming apparatus according to the first embodiment.

FIG. **3** is a sectional explanatory view for illustrating a configuration of a mounting portion of the main body of the image forming apparatus for the support members according to the first embodiment.

FIG. **4** is a perspective explanatory view for illustrating configurations of the support members according to the first embodiment.

FIG. **5** is another perspective explanatory view for illustrating the configurations of the support members according to the first embodiment.

FIG. **6** is a perspective explanatory view for illustrating a cartridge according to the first embodiment as viewed from a driving side.

FIG. **7** is a sectional explanatory view for illustrating a configuration of the cartridge according to the first embodiment.

FIG. **8** is a perspective explanatory view for illustrating a state in which one of the cartridges according to the first embodiment is being mounted into the support member.

FIG. **9** is a perspective explanatory view for illustrating a state in which the cartridges are mounted into the support members according to the first embodiment.

FIG. **10** is a perspective explanatory view for illustrating a state in which one of the support members according to the first embodiment is being mounted into the main body of the image forming apparatus.

FIG. **11** is a perspective explanatory view for illustrating a state in which a support member according to a second embodiment is being mounted into a main body of an image forming apparatus.

FIG. **12** is a perspective explanatory view for illustrating a state in which support members in a reference example are being mounted into a main body of an image forming apparatus.

FIG. **13** is a sectional explanatory view for illustrating a state in which a first support member is being mounted into or pulled out of a main body of an image forming apparatus according to a third embodiment.

FIG. **14** is a sectional explanatory view for illustrating a state in which the first support member and a second support member are being mounted into or pulled out of the main body of the image forming apparatus according to the third embodiment.

FIG. **15** is a perspective explanatory view for illustrating a configuration of a mounting portion of the main body of the image forming apparatus for the support members according to the third embodiment.

FIG. **16** is a perspective explanatory view for illustrating configurations of the support members according to the third embodiment.

FIG. **17** is another perspective explanatory view for illustrating the configurations of the support members according to the third embodiment.

FIG. **18** is a view for illustrating a configuration of an engagement/disengagement mechanism for pulling out the first support member and the second support member according to the third embodiment.

FIG. **19** is another view for illustrating the configuration of the engagement/disengagement mechanism for pulling out the first support member and the second support member according to the third embodiment.

FIG. **20** is a sectional explanatory view for illustrating a configuration of an image forming apparatus according to a fourth embodiment.

DESCRIPTION OF THE EMBODIMENTS

Image forming apparatus according to embodiments of the present invention will be specifically described referring to the accompanying drawings.

First Embodiment

First, referring to FIGS. **1** to **10**, a configuration of an image forming apparatus according to a first embodiment will be described.

<Image Forming Apparatus>

First, an overall configuration of a main body of an image forming apparatus **100** (main body of an image forming apparatus) according to the embodiment will be described referring to FIGS. **1** to **7**. FIG. **1** is a sectional explanatory view for illustrating a configuration of the entire image forming apparatus **100** according to the embodiment. FIG. **2** is a perspective view for illustrating a state in which pullout members **130** and **131** serving as support members for supporting a plurality of cartridges P mountable into and removable from the main body of the image forming apparatus **100** according to the embodiment are pulled out. FIG. **7** is a sectional view for illustrating a configuration of the cartridge P according to the embodiment.

The image forming apparatus **100** according to the embodiment includes photosensitive drums **1**. The photosensitive drums **1** are four electrophotographic photosensitive members serving as image bearing members provided side by side in a horizontal direction indicated as a crosswise direction in FIG. **1**. On each of the image bearing members, an electrostatic latent image is formed. Besides the photosensitive drums **1**, the image forming apparatus **100** also includes the following members as electrophotographic image forming process units. Specifically, the image forming apparatus **100** includes charging rollers **2** serving as charging units, a scanner unit **3** serving as an image exposure unit, developing units **4**Y, **4**M, **4**C, and **4**K serving as developing devices, and an intermediate transfer unit **5** serving as a transfer unit for electrostatic transfer.

The developing units **4**Y, **4**M, **4**C, and **4**K respectively contain developers for yellow Y, magenta M, cyan C, and black K. For convenience of description, the developing units **4**Y, **4**M, **4**C, and **4**K are also described simply as "developing units **4**". The same applies to the other image forming process units. Each of the charging rollers **2** has a function of uniformly charging a surface of the corresponding photosensitive drum **1**. The scanner unit radiates laser

beams L on the surfaces of the photosensitive drums **1** based on image information to form the electrostatic latent images thereon.

The developing units **4** have a function of developing the electrostatic latent images formed on the surfaces of the photosensitive drums **1** by using toners as the developers. The intermediate transfer unit **5** has a function of transferring toner images formed on the surfaces of the photosensitive drums **1** onto a sheet S as a recording material. As specific examples of the sheet S, a paper sheet, an overhead transparency (OHT) sheet (transparent sheet used for an overhead projector (OHP)), and a cloth sheet are given. Further, the image forming apparatus **100** includes cleaning devices **6** serving as cleaning units for removing the toners remaining on the surfaces of the photosensitive drums **1** after the toner images are transferred onto the intermediate transfer belt **11**.

Each of the photosensitive drums **1** includes, for example, an aluminum cylinder having an outer circumferential surface applied with an organic photoconductor layer (photosensitive member) made of an organic photoconductor (OPC). Both ends of each of the photosensitive drums **1** are rotatably supported by a support member (not shown). A first coupling member **47** illustrated in FIG. **6** is provided on one end of each of the photosensitive drums **1**. The first coupling member **47** can be fitted to one of drum coupling members **25** illustrated in FIG. **3** to be engaged therewith so as to receive a rotational driving force from a driving motor (not shown). In this manner, the rotational driving force of the driving motor is transferred to the photosensitive drums **1** through the drum coupling members **25** illustrated in FIG. **3** and the first coupling members **47** illustrated in FIG. **6** so that the photosensitive drums **1** are rotated in a direction indicated by the arrow A in FIG. **1**.

The charging roller **2** according to the embodiment employs a contact charging type. More specifically, the charging roller **2** is a conductive roller formed into a roller shape, and the charging roller **2** abuts against the surface of the photosensitive drum **1**. Then, a charging bias voltage is applied to the charging roller **2** so that the surface of the photosensitive drum **1** is uniformly charged.

The scanner unit **3** is provided below the photosensitive drums **1**, as illustrated in FIG. **1**. In the scanner unit **3**, the laser beams L corresponding to image signals are radiated from laser diodes (not shown) to expose the surfaces of the charged photosensitive drums **1** to light. In this manner, the electrostatic latent images in accordance with the image signals are formed on the surfaces of the photosensitive drums **1**.

The developing units **4** respectively include toner containers **41** containing toners of yellow Y, magenta M, cyan C, and black K, as illustrated in FIG. **7**. Each of the toner containers **41** is provided so as to be opposed to the corresponding photosensitive drum **1**. Each of the toner containers **41** is a developer containing portion for containing the developer (toner) to be supplied to a corresponding developing roller **40**. The developing roller is a developer carrying member for carrying the developer (toner) for developing the electrostatic latent image formed on the surface of the photosensitive drum **1**.

The toners in those toner containers **41** are supplied to toner supply rollers **43**. Then, the toner supply roller **43** and a developing blade **44** that is held in press-contact with an outer circumference of the developing roller **40** cause the toner to be applied to the outer circumference of the developing roller **40** and to be electrically charged.

Then, a developing bias voltage is applied to the developing roller **40** so that the toner adheres to the electrostatic latent image formed on the surface of the photosensitive drum **1**. With this, the toner image is formed. Note that, the developing roller **40** is provided so as to be opposed to and brought into contact with the photosensitive drum **1**. Here, the developing unit **4** and the photosensitive drum **1** are configured integrally to form a process cartridge (hereinafter referred to simply as "cartridge"). In this manner, the cartridges PY, PM, PC, and PK, which are image forming units, are formed. The cartridges P are configured by using a so-called "cartridge system" that allows each of the cartridges P to be individually replaced when the toner is used up by a user and the cartridge comes to the end of a lifetime.

The image forming apparatus **100** is a color image forming apparatus including a plurality of image forming portions for forming images in different colors. The cartridges PY, PM, PC, and PK are respectively used in the different image forming portions.

Specifically, the cartridge PY constructs a yellow image forming portion and is used to form a yellow image. Similarly, the cartridges PM, PC, and PK respectively construct a magenta image forming portion, a cyan image forming portion, and a black image forming portion.

As illustrated in FIG. **1**, in the intermediate transfer unit **5** of the image forming apparatus **100**, an intermediate transfer belt **11** is looped around rollers **5***a*, **5***b*, and **5***c* in a tensed manner so as to be rotatable. On an inner circumferential surface side of the intermediate transfer belt **11**, primary transfer rollers **12**, which are primary transfer units, are provided in positions respectively opposed to the photosensitive drums **1**. By applying a primary transfer bias voltage to the primary transfer rollers **12**, positive electric charges are applied to the intermediate transfer belt **11** from the primary transfer rollers **12**. In this manner, the toner images formed on the surfaces of the photosensitive drums **1** are primarily transferred onto an outer circumferential surface of the intermediate transfer belt **11**.

The image forming apparatus **100** further includes a feed roller **18** having a function of feeding the sheet S to the image forming portions. For the feed roller **18**, a feed cassette **17** for receiving a plurality of the sheets S is provided. At the time of image formation, the feed roller **18** and registration rollers **19** rotate in accordance with an image forming operation.

In this manner, the sheets S received in the feed cassette **17** are fed one by one. Then, the sheet S is conveyed to a secondary-transfer nip portion, which is formed by the intermediate transfer belt **11** looped around the roller **5***b* and a secondary transfer roller **22** serving as a secondary transfer unit, by the registration rollers **19** so that the rotation of the intermediate transfer belt **11** and the toner image are synchronized with each other. By applying a secondary transfer bias voltage to the secondary transfer roller **22**, the toner images formed on the outer circumferential surface of the intermediate transfer belt **11** are secondarily transferred onto the sheet S.

The image forming apparatus **100** includes a fixing device **20** serving as a fixing unit having a function of fixing the toner images in the plurality of colors transferred onto the sheet S. The fixing device **20** includes a heating roller **21***a* and a pressure roller **21***b*. The heating roller **21***a* rotates, whereas the pressure roller **21***b* is held in press-contact with the heating roller **21***a*. Specifically, the sheet S, onto which the toner images formed on the outer circumferential surface of the intermediate transfer belt **11** are transferred, is con-

veyed while being nipped between the heating roller **21***a* and the pressure roller **21***b*. Meanwhile, heat and pressure are applied to the sheet S. In this manner, the toner images in the plurality of colors are fixed onto the surface of the sheet S.

The image forming process is briefly summarized as follows. When the image forming operation is started, the photosensitive drums **1** start rotating. Then, the charging rollers **2** uniformly apply the charges to the surfaces of the photosensitive drums **1**. The scanner unit **3** exposes the surfaces of the photosensitive drums **1** to light in accordance with the image signals so as to form the electrostatic latent images on the surfaces of the photosensitive drums **1**. Then, by the developing rollers **40**, the electrostatic latent images are developed (toners are caused to adhere). In this manner, the photosensitive drums **1** bear the developer images (toner images). The photosensitive drums **1** are image bearing members that bear the images, whereas the developing rollers **40** are developer carrying members for carrying the developers (toners) and developing the latent images.

On the other hand, the toner images in the four colors formed on the outer circumferential surface of the intermediate transfer belt **11** are transferred by the secondary transfer roller **22** onto the sheet S that is fed by the feed roller **18** and conveyed by the registration rollers **19**. The sheet S, on which the toner images in the four colors are transferred, is conveyed to the fixing device **20**. The sheet S, onto which the color images are fixed by the fixing device **20**, is delivered to a delivery portion **24** provided outside of the image forming apparatus **100** by delivery rollers **23**.

<Monochrome Mode>

The image forming apparatus **100** is a color image forming apparatus capable of forming an image in a plurality of colors, specifically, yellow, magenta, cyan, and black.

The image forming apparatus **100** is also capable of forming an image in a single color. Specifically, the image forming apparatus **100** is operable in a monochrome mode for forming an image in black and white by using only the black image forming portion (specifically, the cartridge PK). The user can select any one of the monochrome mode and a color mode for forming a color image by using all the image forming portions (specifically, the cartridges PY, PM, PC, and PK).

When the image forming apparatus **100** operates in the monochrome mode, the image is not formed by the image forming portions (specifically, the cartridges PY, PM, and PC) other than by that for black.

<Support Members>

In the embodiment, the main body of the image forming apparatus **100** (main body) means to include various members (components) constructing the image forming apparatus **100** except for at least the following members. The pullout members **130** and **131** and members (components) that are configured to be fixable to or mountable into and removable from the pullout members **130** and **131** are excluded from the main body.

Next, a configuration of each of the pullout members **130** and **131** serving as support members for supporting the cartridges P will be described referring to FIG. **2**. The pullout members **130** and **131** are configured to be movable independently from each other between an inside position and an outside position. The inside position is located inside of the main body of the image forming apparatus **100**, whereas the outside position is located outside of the main body of the image forming apparatus **100**. FIG. **2** is a perspective view for illustrating a state in which an operation of mounting or pulling the pullout member **130** from the main body of the image forming apparatus **100** according to the embodiment.

As illustrated in FIG. **2**, when a door **10**, which is provided on the main body of the main forming apparatus **100** so as to be openable and closable, is opened, an opening portion **16** appears. Then, through the opening portion **16**, the pullout members **130** and **131** can be pulled out.

The pullout members **130** and **131** are provided to be linearly moved substantially in a horizontal direction indicated by the arrows D**1** and D**2** in FIG. **2** with respect to the main body of the image forming apparatus **100** so that the mounting operation by pressing and the pullout operation can be performed. Then, the pullout members **130** and **131** can be moved between the inside positions inside the main body of the image forming apparatus **100** as illustrated in FIG. **1** and the outside positions outside the main body, respectively. FIG. **2** shows the outside position at which the pullout member **130** is pulled out of the main body of the image forming apparatus **100**.

As illustrated in FIG. **2**, only the pullout member **130**, which is a second support member, is moved to the outside position for the main body of the image forming apparatus **100**. Among the plurality of cartridges P, the pullout member **130** supports the cartridge PK (first cartridge) for forming the image in black K.

FIG. **2** is an illustration of a state in which the pullout member **131**, which is a first support member, is located in the inside position for the main body of the image forming apparatus **100**. The pullout member **131** supports the plurality of cartridges PY, PM, and PC for forming the images in yellow Y, magenta M, and cyan C other than black K as a first color, among the plurality of cartridges P.

As illustrated in FIG. **2**, the pullout member **130** is located in the outside position for the main body of the image forming apparatus **100**. In this state, the cartridge PK for black K is mounted into a mounting portion **130***f* of the pullout member **130** by the user substantially in a gravity direction indicated by the arrow B in FIG. **2**.

The cartridge PK for black K mounted into the mounting portion **130***f* of the pullout member **130** as described above is arranged as follows. The cartridge PK is arranged so that a longitudinal direction (axial direction of the photosensitive drum **1**) becomes parallel to the moving directions of the pullout member **130**, which are indicated by the arrows D**1** and D**2** in FIG. **2**.

For the remaining three cartridges PY, PM, and PC, the pullout member **131** is similarly located in the outside position for the main body of the image forming apparatus **100**. In this state, the cartridges PY, PM, and PC can be mounted into a mounting portion **131***f* of the pullout member **131** by the user substantially in the gravity direction indicated by the arrow B in FIG. **2**.

Specifically, in a state in which the pullout member **130** is located in the outside position for the main body of the image forming apparatus **100**, the cartridge PK can be mounted and removed. Similarly, in a state in which the pullout member **131** is located in the outside position for the main body of the image forming apparatus **100**, the cartridges PY, PM, and PC can be mounted and removed.

The four cartridges PY, PM, PC, and PK are arranged side by side in a direction perpendicular to the moving directions of the pullout members **130** and **131** indicated by the arrows D**1** and D**2** in FIG. **2**. The pullout member **130** supports the cartridge PK, whereas the pullout member **131** supports the cartridges PY, PM, and PC. In this state, the pullout members **130** and **131** are moved between the inside position and

the outside position for the main body of the image forming apparatus **100** along the directions indicated by the arrows D**1** and D**2** in FIG. **2**, which are parallel to the longitudinal direction (axial direction) of the photosensitive drums **1**.

The pullout members **130** and **131** can be pulled out from the inside position for the main body of the image forming apparatus **100** to the outside position for the main body of the image forming apparatus **100**, at which the cartridges PY, PM, PC, and PK can be mounted and removed, through the opening portion **16** formed in the main body of the image forming apparatus **100**.

The cartridges P are moved together with the pullout members **130** and **131** to the inside position illustrated in FIG. **1** and the outside position illustrated in FIG. **2** for the main body of the image forming apparatus **100** in a state in which the cartridges P are mounted in the pullout members **130** and **131**. Then, when the door **10** is closed in a state in which the pullout members **130** and **131** are moved into the main body of the image forming apparatus **100** as illustrated in FIG. **1**, all the cartridges P are positioned at predetermined positions inside the main body of the image forming apparatus **100**.

As described above, according to the image forming apparatus **100** of the embodiment, the cartridge PK for black K alone can be mounted into the main body of the image forming apparatus **100**. In addition, the cartridge PK for black K alone can be pulled out of the main body of the image forming apparatus **100**. Therefore, the four cartridges P are not required to be pulled out together. Thus, only the cartridge PK for black K, which is highly frequently used for both in the monochrome mode and the color mode, can be replaced. Therefore, in contrast to the configuration in which the four cartridges P are inevitably pulled out together, there is provided excellent workability in replacement in a case where the capacity of each of the cartridges P is increased.

Even in an image forming apparatus for which the user cannot make a selection between the monochrome mode and the color mode, the image in black K is generally frequently formed. Therefore, the configuration, in which only the cartridge PK for black K is supported by the pullout member **130** so as to be mounted into the main body of the image forming apparatus **100**, is effective.

Further, the pullout member **131** supports the plurality of cartridges P. Specifically, the plurality of cartridges PY, PM, and PC, which are relatively less frequently used, are all supported by the pullout member **131**. Therefore, the number of pullout members can be kept down to two in total. Accordingly, the configuration of the image forming apparatus **100** can be prevented from becoming complex and increasing in size due to an increased number of pullout members.

<Mounting Portion for Support Members>

Next, a configuration of a mounting portion **7** of the main body of the image forming apparatus **100** for the pullout members **130** and **131** will be described referring to FIGS. **3** to **5**. FIG. **3** is a sectional view for illustrating the configuration of the mounting portion **7** of the main body of the image forming apparatus **100** for the pullout members **130** and **131** according to the embodiment. FIGS. **4** and **5** are perspective views for illustrating a configuration of engagement portions of the pullout members **130** and **131**, which are to be engaged with the mounting portion **7** of the main body of the image forming apparatus **100** according to the embodiment. In FIG. **3**, the intermediate transfer unit **5** is omitted from the members (components) constructing the image forming apparatus **100** for easy understanding of the configuration of the mounting portion **7**.

As illustrated in FIG. **3**, guiding members **140** to **142** for guiding the directions of movement of the pullout members **130** and **131** are provided inside of the main body of the image forming apparatus **100**. In the guiding members **140** to **142**, a pair of guiding portions **140**R and **141**L and a pair of guiding portions **141**R and **142**L are formed so that the guiding portions **140**R and **141**L are opposed to each other and the guiding portions **141**R and **142**L are opposed to each other.

Each of the guiding portions **140**R, **141**L, **141**R, and **142**L has a groove portion with a U-like cross section. Guided portions **130***a* and **130***b* of the pullout member **130** and guided portions **131***d* and **131***c* of the pullout member **131** illustrated in FIGS. **4** and **5** are slidably fitted into the guiding portions **140**R and **141**L and the guiding portions **141**R and **142**L, respectively. In this manner, the pullout members **130** and **131** are movably guided in the directions indicated by the arrows D**1** and D**2** illustrated in FIG. **2** along the guiding portions **140**R and **141**L and the guiding portions **141**R and **142**L, respectively.

The guiding portions **140**R, **141**L, **141**R, and **142**L can guide the pullout members **130** and **131** from a position, at which the pullout members **130** and **131** are pulled out of the main body of the image forming apparatus **100**, to a position at which the pullout members **130** and **131** are accommodated into the main body of the image forming apparatus **100**. The guiding portions **140**R, **141**L, **141**R, and **142**L are provided so as to extend substantially in a horizontal direction from the vicinity of an inlet of the opening portion **16**, at which the door **10** for the main body of the image forming apparatus **100** is provided, to a far side of the main body of the image forming apparatus **100**.

As illustrated in FIG. **3**, inside the main body of the image forming apparatus **100**, the drum coupling members **25** for transferring the drive to the photosensitive drums **1** are provided. Further, development coupling members **26** for transferring the drive to the developing rollers **40** are also provided. The drum coupling members **25** are provided at equal intervals in the horizontal direction, whereas the development coupling members **26** are provided at equal intervals in the horizontal direction.

The drum coupling members **25** and the development coupling members **26** transfer the rotational driving force from the motor serving as a driving source (not shown) to the photosensitive drums **1** and the developing rollers **40** provided rotatably in the cartridges P. In a state in which the door **10**, which is provided on the main body of the image forming apparatus **100** so as to be openable and closable, is opened, the drum coupling members **25** and the development coupling members **26** retract inside side walls of the main body of the image forming apparatus **100**.

Then, in conjunction with the operation of closing the door **10**, the drum coupling members **25** and the development coupling members **26** project from one of the side walls of the main body of the image forming apparatus **100**. Then, the drum coupling members **25** and the development coupling members **26** move toward the first coupling members **47** and the second coupling members **45** of FIG. **6** provided on the longitudinal ends of the cartridges P so as to come into engagement therewith. As a result, the rotational driving force can be transferred.

<Support Members>

Next, the configurations of the pullout members **130** and **131**, which are the support members, are described referring to FIGS. **4** and **5**. FIG. **4** is a perspective view of the pullout members **130** and **131** in the main body of the image forming apparatus **100** according to the embodiment. FIG. **5**

is a perspective view of the pullout members **130** and **131** as viewed from a side opposite to that in FIG. **4**.

As illustrated in FIGS. **4** and **5**, the guided portions **130***a* and **130***b* to be guided by the guiding portions **140**R and **140**L of the main body of the image forming apparatus **100** illustrated in FIG. **3** are formed on both ends of the pullout member **130** in a direction of arrangement of the cartridges. The guided portions **130***a* and **130***b* are extended in the longitudinal direction of the pullout member **130**. The guided portions **131***d* and **131***c* to be guided by the guiding portions **141**R and **142**L of the main body of the image forming apparatus **100** illustrated in FIG. **3** are formed on both ends of the pullout member **131** in the direction of arrangement of the cartridges. The guided portions **131***d* and **131***c* are extended in the longitudinal direction of the process cartridge P mounted in the pullout member **131**.

The guided portion **130***a* is slidably fitted to the guiding portion **140**R to be guided, whereas the guided portion **130***b* is slidably fitted to the guiding portion **141**L to be guided. Further, the guided portion **131***d* is slidably fitted to the guiding portion **141**R to be guided, whereas the guided portion **131***c* is slidably fitted to the guiding portion **142**L to be guided.

A grip portion **28** for allowing the user to operate the pullout member **130** is provided on one end of the pullout member **130**, as illustrated in FIG. **5**. A grip portion **29** is provided on one end of the pullout member **131**.

Further, the mounting portion **130***f* for mounting the cartridge PK for black K is formed in the pullout member **130**, whereas the mounting portion **131***f* for mounting the cartridges P for the other colors is formed in the pullout member **131**.

Further, as illustrated in FIGS. **4** and **5**, slits **13**, each being an elongated through hole, are formed through bottom portions of the mounting portion **130***f* of the pullout member **130** and the mounting portion **131***f* of the pullout member **131** so as to correspond to the positions of the respective photosensitive drums **1**. The slits **13** are openings through which the laser beams L emitted from the scanner unit **3** illustrated in FIG. **1** pass.

Guiding portions **130***h* to **130***k* are respectively formed on inner wall surfaces on both longitudinal ends of the mounting portion **130***f* formed in the pullout member **130**, as illustrated in FIGS. **4** and **5**. Each of the guiding portions **130***h* to **130***k* is a groove portion that is open upward, for mounting the cartridge PK for black K into the mounting portion **130***f* of the pullout member **130**.

Each of the guiding portions **130***h* to **130***k* extends in a vertical direction indicated by the arrow B in FIGS. **4** and **5**. A positioning portion **130***p* is formed on an upper portion of the inner wall on one longitudinal end of the mounting portion **130***f* so as to be located between the guiding portions **130***h* and **130***i*, whereas a positioning portion **130***q* is formed on an upper portion of the inner wall on another longitudinal end of the mounting portion **130***f* so as to be located between the guiding portions **130***j* and **130***k*. The positioning portions **130***p* and **130***q* position the cartridge PK for black K with respect to the pullout member **130**. Each of the positioning portions **130***p* and **130***q* is formed to have a V-shaped cross section.

Similarly, guiding portions **131***h* to **131***k* are formed on inner wall surfaces of both longitudinal ends of the mounting portion **131***f* formed in the pullout member **131**, as illustrated in FIGS. **4** and **5**. Each of the guiding portions **131***h* to **131***k* is a groove portion that is open upward, for mounting the cartridges P for the other colors into the mounting portion **131***f* of the pullout member **131**.

Each of the guiding portions **131***h* to **131***k* extends in the vertical direction indicated by the arrow B in FIGS. **4** and **5**. A positioning portion **131***p* is formed on an upper portion of the inner wall of one longitudinal end of the mounting portion **131***f* so as to be located between the guiding portions **131***h* and **131***i*, whereas a positioning portion **131***q* is formed on an upper portion of the inner wall of another longitudinal end of the mounting portion **131***f* so as to be located between the guiding portions **131***j* and **131***k*. The positioning portions **131***p* and **131***q* position the cartridges PY, PM, and PC for the other colors with respect to the pullout member **131**. Each of the positioning portions **131***p* and **131***q* is formed to have a V-shaped cross section.

As illustrated in FIG. **4**, the pullout member **130** has an opening portion **130***m*. The opening portion **130***m* is a through hole into which the development coupling member **26** illustrated in FIG. **3** moves. The development coupling member **26** illustrated in FIG. **3** moves into the opening portion **130***m*, which is the through hole, in conjunction with the operation of closing the door **10** illustrated in FIG. **2**. Then, the development coupling member **26** is fitted and coupled to the second coupling member **45**K which is provided on a rotary shaft of an intermediate gear (not shown) meshing with a driving gear provided on an end of a rotary shaft of the developing roller **40**K of the cartridge PK illustrated in FIG. **6**.

Further, the pullout member **131** has opening portions **131***m*. The opening portions **131***m* are through holes into which the development coupling members **26** illustrated in FIG. **3** move. The development coupling members **26** illustrated in FIG. **3** move into the opening portions **131***m*, which are the through holes, in conjunction with the operation of closing the door **10** illustrated in FIG. **2**. Then, the development coupling members **26** are fitted and coupled to the second coupling members **45** which are provided on rotary shafts of intermediate gears (not shown) meshing with driving gears provided on ends of rotary shafts of the developing rollers **40** of the other cartridges P illustrated in FIG. **6**.

<Cartridges>

Next, a configuration of each of the cartridges P to be mounted in the pullout members **130** and **131** will be described referring to FIGS. **6** to **8**. FIG. **6** is a perspective view for illustrating the configuration of the cartridge P according to the embodiment. FIG. **7** is a sectional view for illustrating the configuration of the cartridge P according to the embodiment. FIG. **8** is a perspective view for illustrating a state in which the cartridge PK for black K according to the embodiment is being mounted into the pullout member **130**.

As illustrated in FIGS. **6** and **7**, the cartridge P includes a photosensitive member unit **8** and the developing unit **4**. The photosensitive member unit **8** includes the photosensitive drum **1**, a frame **8***a* for supporting the photosensitive drum **1**, the charging roller **2**, the cleaning device **6**, and a waste toner container **30** for containing the toner removed by the cleaning device **6**.

Further, the developing unit **4** includes the developing roller **40**, a frame **4***a* for supporting the developing roller **40**, and the toner supply roller **43**. The developing unit **4** further includes the developing blade **44**, the toner container **41** for containing the toner to be used for image formation, and a conveying member **48** for supplying the toner in the toner container **41**.

As illustrated in FIG. **7**, the toner in the toner container **41** is supplied to the toner supply roller **43** by the conveying member **48**. Then, the toner supply roller **43** and the developing blade **44** that is held in press-contact with the surface

of the developing roller **40** cause the toner to be applied to the surface of the developing roller **40** and to be electrically charged.

Then, a developing bias voltage is applied from the main body of the image forming apparatus **100** to the developing roller **40**. As a result, the toner adheres to the electrostatic latent image formed on the surface of the photosensitive drum **1** to form the toner image. After the toner image developed on the surface of the photosensitive drum **1** is transferred onto the outer circumferential surface of the intermediate transfer belt **11**, the toner remaining on the surface of the photosensitive drum **1** is removed by the cleaning device **6** so as to be contained in the waste toner container **30**.

When the toner in the toner container **41** is used up, the user can perform printing again after replacing the cartridge P. As illustrated in FIG. **6**, the first coupling member **47** provided on one end of the rotary shaft of the photosensitive drum **1** is rotatably supported by one longitudinal end of the cartridge P. The first coupling member **47** is coupled to the drum coupling member **25** provided on the main body of the image forming apparatus **100**, which is illustrated in FIG. **3**, so as to receive the rotational driving force.

Further, the second coupling member **45**, which is provided on the rotary shaft of the intermediate gear (not shown) meshing with the driving gear provided on one end of the rotary shaft of the developing roller **40**, is rotatably supported by the one longitudinal end of the cartridge P. The second coupling member **45** is coupled to the development coupling member **26** provided on the main body of the image forming apparatus **100**, which is illustrated in FIG. **3**, so as to receive the rotational driving force.

The photosensitive drum **1** is rotated by the rotational driving force that is received by the first coupling member **47** illustrated in FIG. **6** from the main body of the image forming apparatus **100** through the drum coupling member **25** illustrated in FIG. **3**. Further, the rotational driving force, which is received by the second coupling member **45** illustrated in FIG. **6** from the main body of the image forming apparatus **100** through the development coupling member **26** illustrated in FIG. **3**, is transferred as follows. The rotational driving force is transferred through the intermediate gear (not shown) to the developing roller **40**, the toner supply roller **43**, and the conveying member **48** so that the developing roller **40**, the toner supply roller **43**, and the conveying member **48** rotate simultaneously.

As illustrated in FIG. **6**, an engagement portion **71***a*, which is a cylindrical rib and covers the second coupling member **45**, is formed on an outer circumference of the second coupling member **45**. The engagement portion **71***a* is formed on a side cover **71** that is fixed to one longitudinal end of the toner container **41**.

The second coupling member **45** is configured to be rotatable with respect to the engagement portion **71***a*. Further, as illustrated in FIG. **8**, an engagement portion **70***a* is formed on the side opposite to the engagement portion **71***a*. Similarly to the engagement portion **71***a*, the engagement portion **70***a* is formed on a side cover **70** that is fixed to another longitudinal end of the toner container **41**. The engagement portions **71***a* and **70***a* are both formed on the developing unit **4**.

Further, hole portions **8***b* and **8***c* are formed in the frame **8***a* of the photosensitive member unit **8**. The hole portions **8***b* and **8***c* are through holes through which the engagement portions **71***a* and **70***a* formed on the developing unit **4** are inserted so as to turnably support the engagement portions **71***a* and **70***a*.

The hole portions **8***b* and **8***c* formed in the frame **8***a* of the photosensitive member unit **8** respectively come into engagement with the engagement portions **71***a* and **70***a* formed on the development unit **4**. In this manner, the photosensitive member unit **8** and the developing unit **4** are coupled to each other so as to be turnable about the engagement portions **71***a* and **70***a* as a center.

The engagement portions **71***a* and **70***a* formed on the developing unit **4** are configured to turn with respect to the hole portions **8***b* and **8***c* formed in the frame **8***a* of the photosensitive member unit **8** so as to be movable. Therefore, the developing unit **4** can turn about the engagement portions **71***a* and **70***a* as a center with respect to the photosensitive member unit **8** to move. Specifically, the developing roller **40** is configured to be movable with respect to the photosensitive drum **1**.

A spring **9** is provided as a biasing member between the photosensitive member unit **8** and the developing unit **4**, as illustrated in FIGS. **6** and **7**. The spring **9** is provided on a side opposite to the developing roller **40** and the photosensitive drum **1** across the engagement portions **71***a* and **70***a*. The developing roller **40** is pressed by the spring **9** against the photosensitive drum **1** with a predetermined pressure.

As illustrated in FIG. **6**, a positioned portion **8***d*, which is a cylindrical rib and covers the first coupling member **47**, is formed on an outer circumference of the first coupling member **47**. Further, as illustrated in FIG. **8**, a positioned portion **8***e*, which is formed as a cylindrical projection, is formed on the photosensitive member unit **8** on the side opposite to the side where the positioned portion **8***d* is formed, in the longitudinal direction.

Further, as illustrated in FIG. **6**, a rotation regulated portion **8***f* having an oval cross section is formed below the positioned portion **8***d* illustrated in FIG. **6**. As illustrated in FIG. **8**, a rotation regulated portion **8***g* having an oval cross section is formed below the positioned portion **8***e* illustrated in FIG. **8**.

Each of the rotation regulated portions **8***f* and **8***g* has a columnar shape with an oval cross section, which extends in the same direction as a direction in which the cartridges P are mounted into the pullout members **130** and **131**.

The positioned portions **8***d* and **8***e* and the rotation regulated portions **8***f* and **8***g* formed on the longitudinal ends of the photosensitive member unit **8** have a function of positioning the cartridge P inside the pullout member **130** or **131**.

Further, regulated portions **8***j* and **8***k*, each having a columnar shape, are respectively formed below the rotation regulated portions **8***f* and **8***g* formed on the longitudinal ends of the photosensitive member unit **8** in FIGS. **6** and **8**. Regulated portions **4***j* and **4***k*, each having a columnar shape, are formed on the longitudinal ends of the developing unit **4** so as to correspond to height positions of the regulated portions **8***j* and **8***k*.

The regulated portions **8***j* and **8***k* are formed on the photosensitive member unit **8** at such positions that the photosensitive drum **1** is interposed therebetween, whereas the regulated portions **4***j* and **4***k* are formed on the developing unit **4** at such positions that the photosensitive drum **1** is interposed therebetween. The regulated portions **8***j*, **4***j*, **8***k*, and **4***k* are formed at substantially the same position in the direction indicated by the arrow B in FIG. **8**, in which the cartridges P are mounted into the pullout members **130** and **131**.

<Operation of mounting Cartridges to Support Members>

Next, an operation of mounting the cartridges P into the mounting portion **130***f* of the pullout member **130** and the mounting portion **131***f* of the pullout member **131** will be

described referring to FIGS. **8** and **9**. For convenience of the description, mounting of the cartridge PK for black K into the pullout member **130** is representatively described. FIG. **8** is a perspective view for illustrating a state in which the cartridge PK for black K is mounted into the mounting portion **130***f* of the pullout member **130**. FIG. **9** is a perspective view for illustrating a state in which all the cartridges P are mounted in the mounting portion **130***f* of the pullout member **130** and the mounting portion **131***f* of the pullout member **131**.

As illustrated in FIG. **8**, the cartridge PK for black K is mounted into the mounting portion **130***f* formed in the pullout member **130**. The user mounts the cartridge PK for black K into the mounting portion **130***f* formed in the pullout member **130** in the direction indicated by the arrow B in FIG. **8**, which is substantially the gravity direction.

The cartridge PK for black K is mounted into the mounting portion **130***f* formed in the pullout member **130**. In this case, the user first mounts the regulated portions **8***j*, **4***j*, **8***k*, and **4***k* illustrated in FIGS. **6** and **8**, which are formed on the both longitudinal ends of the cartridge PK for black K in the following manner.

Specifically, the regulated portions **8***j*, **4***j*, **8***k*, and **4***k* are inserted along the guiding portions **130***h* to **130***k* formed on the inner wall surfaces of the mounting portion **130***f* of the pullout member **130** illustrated in FIGS. **4** and **5** in the direction indicated by the arrow B in FIG. **8**, which is the gravidity direction, so as to be mounted into the mounting portion **130***f*. In this state, the cartridge PK for black K is mounted into the mounting portion **130***f* formed in the pullout member **130** with a predetermined clearance therebetween.

Further, the user inserts the rotation regulated portions **8***f* and **8***g*, which are formed on the both longitudinal ends of the photosensitive member unit **8**, along the guiding portions **130***i* and **130***k* formed on the inner wall surfaces of the mounting portion **130***f* of the pullout member **130** in the direction indicated by the arrow B in FIG. **8**, which is the gravity direction.

In this manner, the cartridge PK for black K is guided by the guiding portions **130***h* to **130***k* formed on the inner wall surfaces of the mounting portion **130***f* of the pullout member **130** illustrated in FIGS. **4** and **5** to be mounted into the mounting portion **130***f* of the pullout member **130**.

The cartridge PK for black K is mounted into the mounting portion **130***f* of the pullout member **130**. Then, the positioned portions **8***d* and **8***e*, each having a columnar shape, formed on the both longitudinal ends of the cartridge PK illustrated in FIGS. **6** and **8** come into abutment against the positioning portions **130***p* and **130***q*, each having a V-shaped cross section, formed on the upper portions of the wall surfaces of the mounting portion **130***f* of the pullout member **130**. In this manner, the cartridge PK for black K can be positioned in the mounting direction indicated by the arrow B in FIG. **8**.

Further, the rotation regulated portions **8***f* and **8***g* formed on the both longitudinal ends of the photosensitive member unit **8** are as follows. The rotation regulated portions **8***f* and **8***g* respectively come into abutment against side surfaces of the guiding portions **130***i* and **130***k* formed on the inner wall surfaces of the mounting portion **130***f* of the pullout member **130** illustrated in FIGS. **4** and **5** to allow the cartridge PK for black K to be positioned in a rotating direction.

Then, by the positioned portions **8***d* and **8***e* and the rotation regulated portions **8***f* and **8***g* formed on the both longitudinal ends of the photosensitive member unit **8**, the cartridge PK for black K can be positioned inside the positioning portion **130***f* of the pullout member **130**.

The regulated portions **8***j*, **4***j*, **8***k*, and **4***k* formed on the both longitudinal ends of the cartridge PK for black K illustrated in FIGS. **6** and **8** retract as follows. The regulated portions **8***j*, **4***j*, **8***k*, and **4***k* retract into retraction portions **130***h***1** to **130***k***1** (only retraction portions **130***i***1** and **130***k***1** are illustrated in FIGS. **4** and **5**). The retraction portions **130***h***1** to **130***k***1** are formed in communication respectively with lower ends of vertical groove portions as the guiding portions **130***h* to **130***k* formed on the inner wall surfaces of the mounting portion **130***f* of the pullout member **130** illustrated in FIGS. **4** and **5** so as to expand in the horizontal direction.

In a state in which the regulated portions **8***j*, **4***j*, **8***k*, and **4***k* retract into the retraction portions **130***h***1** to **130***k***1**, the regulated portions **8***j*, **4***j*, **8***k*, and **4***k* do not interfere with and disturb the positioning of the cartridge PK for black K with respect to the mounting portion **130***f* of the pullout member **130**.

Similarly, the cartridges PY, PM, and PC are also mounted into the mounting portion **131***f* of the pullout member **131**. The regulated portions **8***j*, **4***j*, **8***k*, and **4***k* formed on both longitudinal ends of the cartridges P for the other colors illustrated in FIGS. **6** and **8** retract as follows. The regulated portions **8***j*, **4***j*, **8***k*, and **4***k* retract into the retraction portions. The retraction portions are formed in communication respectively with the lower ends of the vertical groove portions as the guiding portions **131***h* to **131***k* formed on the inner wall surfaces of the mounting portion **131***f* of the pullout member **131** illustrated in FIGS. **4** and **5** so as to expand in the horizontal direction.

<Operation of Mounting Support Members into Main Body of Image Forming Apparatus>

Next, an operation of mounting pullout units U**1** and U**2**, in which the cartridges P for the respective colors are mounted into the mounting portion **130***f* of the pullout member **130** and the mounting portion **131***f* of the pullout member **131**, into the main body of the image forming apparatus **100** will be described referring to FIGS. **9** and **10**.

For convenience of the description, an operation of mounting the pullout unit U**1** into the main body of the image forming apparatus **100** is representatively described. As illustrated in FIG. **9**, the pullout member **130** in a state in which the cartridge PK for black K is mounted in the mounting portion **130***f* is referred to as "pullout unit U**1**". The pullout member **131** in a state in which the cartridges PY, PM, and PC for the other colors are mounted in the mounting portion **131***f*, is referred to as "pullout unit U**2**".

FIG. **10** is a perspective view for illustrating a state in which the pullout unit U**1** according to the embodiment is being mounted into the main body of the image forming apparatus **100**. As illustrated in FIG. **10**, the guided portions **130***a* and **130***b* of the pullout unit U**1**, which are flange portions formed along the longitudinal direction of the pullout member **130**, are mounted in the following manner. The guided portions **130***a* and **130***b* are respectively fitted into the guiding portions **140**R and **141**R formed on the main body of the image forming apparatus **100** illustrated in FIG. **3** and are mounted along the guiding portions **140**R and **141**R in the direction indicated by the arrow D**1** in FIG. **10**.

As illustrated in FIG. **10**, the intermediate transfer unit **5** is moved by a moving unit (not shown) in conjunction with the operation of opening the door **10** supported turnably by the main body of the image forming apparatus **100** so as to retract from an image forming position.

Therefore, during the operation of mounting and pulling out the pullout unit U1, the surface of the photosensitive drum **1** and the outer circumferential surface of the intermediate transfer belt **11** of the intermediate transfer unit **5** do not slide against each other. The pullout unit U2 can be mounted into the main body of the image forming apparatus **100** in the same manner.

FIG. **1** is an illustration of a state in which the door **10** illustrated in FIG. **10** is closed. Along with the user's operation of closing the door **10**, the drum coupling members **25** and the development coupling members **26** illustrated in FIG. **3** project from the side wall of the main body of the image forming apparatus **100**. The development coupling members **26** move into the opening portions **130***m* and **131***m* in the following manner.

Specifically, the development coupling members **26** move into the opening portion **130***m* that is formed through one-side wall surface of the pullout member **130** and the opening portions **131***m* that are formed through one-side wall surface of the pullout member **131**, which are illustrated in FIGS. **4** and **5**. Further, the intermediate transfer unit **5** moves down in conjunction with the operation of closing the door **10**. As a result, the surfaces of the photosensitive drums **1** come into abutment against the outer circumferential surface of the intermediate transfer unit **5** to receive a pressing force.

The positioned portions **8***d* and **8***e* formed on the both longitudinal ends of the cartridges P illustrated in FIGS. **6** and **8** are pressed against the positioning portions **130***p*, **130***q*, **131***p*, and **131***q* in the following manner. The positioned portions **8***d* and **8***e* are pressed against the positioning portions **130***p* and **130***q* formed on the upper portions of the wall surfaces of the both longitudinal ends of the mounting portion **130***f* of the pullout member **130** and the positioning portions **131***p* and **131***q* formed on the upper portions of the wall surfaces of the both longitudinal ends of the mounting portion **131***f* of the pullout member **131**, which are illustrated in FIGS. **4** and **5**. In this manner, the positions of the respective cartridges P, which are accommodated in the mounting portion **130***f* of the pullout member **130** and the mounting portion **131***f* of the pullout member **131**, are determined inside the main body of the image forming apparatus **100**.

<Excellent Points in the Embodiment>

According to the first embodiment, when the cartridge P of a certain color is to be replaced, all the cartridges P mounted into the mounting portion **130***f* of the pullout member **130** and the mounting portion **131***f* of the pullout member **131** are not required to be pulled out of the main body of the image forming apparatus **100**. Therefore, excellent convenience is provided.

In the embodiment, as illustrated in FIG. **2**, there has been described the example where the pullout unit U1, in which the most frequently used cartridge PK for black K alone is mounted in the pullout member **130**, is mounted into the main body of the image forming apparatus **100** independently of the pullout unit U2. However, the cartridge to be mounted in the pullout member **130** is not required to be limited to the cartridge PK for black K.

Further, in the embodiment, there has been described the example where the pullout unit U2, in which the three cartridges PY, PM, and PC for yellow Y, magenta M, and cyan C are mounted in the pullout member **131**, is mounted into the main body of the image forming apparatus **100**.

Besides, the pullout unit U can be configured so that the pullout member **131** is further divided into two, for example, one for the two cartridges PY and PM for yellow Y and magenta M and the other for the cartridge PC for cyan C.

Further, the pullout unit U can also be divided into two, specifically, one for the cartridge PY for yellow Y and the other for the cartridge PM for magenta M and the cartridge PC for cyan C. The parts obtained by dividing the pullout unit U are mounted into the main body of the image forming apparatus **100** so that each of the parts can be pulled out independently. The details are described later in a second embodiment of the present invention.

Further, in the embodiment, as illustrated in FIG. **1**, there has been described the example of the configuration in which the scanner unit **3** is provided inside the main body of the image forming apparatus **100** so that the surfaces of the photosensitive drums **1** are exposed to the laser beams L in accordance with the image information, which are radiated from below the photosensitive drums **1** in FIG. **1**. Besides, the scanner unit **3** may be provided inside the main body of the image forming apparatus **100** so that the surfaces of the photosensitive drums **1** are exposed to the laser beams L in accordance with the image information, which are radiated from above the photosensitive drums **1**.

Further, in the embodiment, there has been described the example of the cartridge P including the photosensitive member unit **8** and the developing unit **4**. Besides, the cartridge P may also be configured by using a cartridge system that allows the photosensitive member unit **8** and the developing unit **4** to be replaced separately.

Further, in the embodiment, the example of an intermediate transfer member has been described as an example of the intermediate transfer unit **5**. Besides, the sheet S, which is a transferred material, may be conveyed to the transfer portion in which the surface of the photosensitive drum **1** and the transfer unit are opposed to each other so that the toner image formed on the surface of the photosensitive drum **1** is directly transferred onto the sheet S.

Further, the pullout units U1 and U2 can be pulled out independently. Therefore, even if the capacity of each of the cartridges P increases to increase the weight, the mounting and pullout operation can be easily performed. Moreover, when the pullout units U1 and U2 are pulled out, a gravity of the main body of the image forming apparatus **100** is not shifted. Therefore, the main body of the image forming apparatus **100** does not fall down.

Second Embodiment

Next, a configuration of an image forming apparatus according to a second embodiment of the present invention will be described referring to FIG. **11**. Components or members configured similarly to those in the first embodiment described above are denoted by the same reference symbols or are denoted by the same names even though different reference symbols are given, and the description thereof is herein omitted.

In the first embodiment described above, there has been described the example where the pullout unit U1, in which the cartridge PK for black K is mounted in the mounting portion **130***f* of the pullout member **130**, is mounted into the main body of the image forming apparatus **100**.

On the other hand, an image forming apparatus **300** of the second embodiment includes a pullout member **150** serving as a support member for supporting the cartridges PC and PK. The image forming apparatus **300** includes a pullout unit U3 in which the cartridges PC and PK are mounted in a mounting portion of the pullout member **150**.

The image forming apparatus **300** also includes a pullout member **151** serving as a support member for supporting the cartridges PY and PM. The image forming apparatus **300** includes a pullout unit U**4** in which the cartridges PY and PM are mounted in a mounting portion of the pullout member **151**.

The pullout units U**3** and U**4** (support members) can be moved independently of each other between an inside position for the main body of the image forming apparatus **300** and an outside position for the main body of the image forming apparatus **300**. The pullout members **150** and **151** (support members) are configured so that the two cartridges PY and PM can be mounted and removed in a state in which the pullout member **151** is located in the outside position for the main body of the image forming apparatus **300** and the two cartridges PC and PK can be mounted and removed in a state in which the pullout member **150** is located in the outside position for the main body of the image forming apparatus **300**.

Each of the pullout units U**3** and U**4** (support members) is configured so that the pullout units U**3** and U**4** can be mounted into and pulled out of the main body of the image forming apparatus **300**. A configuration of each of the cartridges P and a configuration of mounting the cartridges P into the pullout members **150** and **151** are the same as those of the first embodiment described above. Therefore, the overlapping description thereof is herein omitted.

FIG. **11** is a perspective view for illustrating a state in which the pullout units U**3** and U**4** according to the second embodiment are being pressed into the main body of the image forming apparatus **300** to be mounted therein or being pulled out of the main body of the image forming apparatus **300**. As illustrated in FIG. **11**, the pullout unit U**3** is as follows.

Specifically, guided portions **150***a* and **150***b*, which are flange portions formed on the pullout member **150**, are slidably fitted respectively into a guiding portion **160**R of a guiding member **160** and an unshown guiding portion of a guiding member **161**. Each of the guiding portions is a concave portion having a U-like cross section. The guiding members **160** and **161** are provided on the main body of the main body of the image forming apparatus **300**.

Each of the pullout units U**3** and U**4** can be pressed into the main body of the image forming apparatus **300** in a direction indicated by the arrow D**1** in FIG. **11** to be mounted therein and can be pulled out of the main body of the image forming apparatus **300** in a direction indicated by the arrow D**2** in FIG. **11**. In FIG. **11**, the guiding portion **161**L is located invisibly.

Even in the second embodiment, the intermediate transfer unit **5** moves up from the image forming position to retract in conjunction with the operation of opening the door **10** provided on the main body of the image forming apparatus **300** so as to be openable and closable, as in the first embodiment. Therefore, during the operation of mounting or pulling out the pullout units U**3** and U**4**, the surfaces of the photosensitive drums **1** and the outer circumferential surface of the intermediate transfer unit **5** do not slide against each other.

The pullout unit U**4** has guided portions **151***a* and **151***b*, which are flange portions formed on the pullout member **151**. The guided portions **151***a* and **151***b* are formed as follows. The guided portions **151***a* and **151***b* are formed to be slidably fitted respectively into an unshown guiding portion formed on the guiding member **161** and a guiding portion **162**L formed on a guiding member **162**. The guiding members **161** and **162** are provided on the main body of the image forming apparatus **300**. Each of the guiding portions is a concave portion having a U-like cross section.

According to the second embodiment, when the cartridges P for the two colors arranged in the same pullout unit are to be replaced, all the cartridges P mounted into the pullout members **150** and **151** are not required to be pulled out of the main body of the image forming apparatus **300**. Therefore, excellent convenience is provided.

In the embodiment, the pullout unit U**3**, in which the two cartridges PC and PK for cyan C and black K are mounted in the mounting portion of the pullout member **150**, is provided. Further, the pullout unit U**4**, in which the two cartridges PY and PM for yellow Y and magenta M are mounted in the mounting portion of the pullout member **151**, is provided. In the embodiment, there has been described the example of the configuration in which the pullout units U**3** and U**4** can be mounted into and pulled out of the main body of the image forming apparatus **300** independently. The combinations of colors, specifically, yellow Y, magenta M, cyan C, and black K, may be different. Further, the colors of the developers are not limited. The remaining configuration is the same as that of the first embodiment, and the same effects can be obtained.

Specifically, the image forming apparatus **300** includes the plurality of pullout members **150** and **151**. Therefore, the number of cartridges to be mounted into one pullout member is small. Therefore, a load is reduced when the user moves each of the pullout members **150** and **151**.

On the other hand, each of the pullout members **150** and **151** has a configuration of supporting the plurality of cartridges. Therefore, the number of pullout members to be provided on the image forming apparatus **300** is kept down to a small number (two in this case). Thus, the configuration of the image forming apparatus **300** can be prevented from becoming complex and increasing in size.

Further, even in the embodiment, the cartridge PK for black K, which is highly frequently used, can be pulled out of the main body independently of the cartridge PY for yellow Y and the cartridge PM for magenta M. Thus, a load can be reduced when the cartridge PK for black K is replaced.

However, the pullout member **150** of the embodiment supports not only the cartridge PK for black K but also the cartridge PC for cyan C. Therefore, the load imposed when the pullout member **150** is moved becomes larger than that when the pullout member **130** (see FIG. **2**) of the first embodiment is moved. However, there is an advantage in that the load imposed when the pullout member **151**, which supports the two cartridges for yellow Y and magenta M, is moved becomes correspondingly smaller than that imposed when the pullout member **131** (see FIG. **2** in the first embodiment), which supports the three cartridges for yellow Y, magenta M, and cyan C, is moved.

Specifically, in the second embodiment, there is provided the configuration in which the load imposed when the cartridge PK for black K is replaced and the load imposed when the other cartridges PY, PM, and PC are replaced are balanced. The pullout members of the first embodiment or the pullout members of the second embodiment can be appropriately selected to be used depending on functions and modes required for the image forming apparatus. It is preferred that the number of cartridges to be supported by each of the pullout members satisfy the following relationship. It is preferred that the number of cartridges to be supported by the pullout member **130** or **150**, which supports

the cartridge PK for black K, be equal to or smaller than a total number of cartridges supported by the other pullout member **131** or **151**.

This is because the load at the time of movement is preferably reduced for the pullout member that is more frequently moved (pullout member that supports the cartridge PK for black K).

Reference Example

Next, a reference configuration for comparison with the configurations of the first embodiment and the second embodiment will be described referring to FIG. **12**. Components or members configured similarly to those in the embodiments described above are denoted by the same reference symbols or are denoted by the same names even though different reference symbols are given, and the description thereof is herein omitted.

In the first embodiment described above, there has been described the example where the pullout unit U**1**, in which the cartridge PK for black K alone is mounted in the mounting portion **130***f* of the pullout member **130**, is independently mounted into the main body of the image forming apparatus **100**.

In the reference configuration, as illustrated in FIG. **12**, the plurality of cartridges P, which can be mounted into and removed from a main body of an image forming apparatus **400**, include the following. The cartridge PY for forming an image in yellow Y, the cartridge PM for forming an image in magenta M, the cartridge PC for forming an image in cyan C, and the cartridge PK for forming an image in black K are arranged. The image forming apparatus **400** also includes pullout members **170**, **171**, **172**, and **173**, which are a plurality of support members for independently supporting the cartridges PY, PM, PC, and PK.

Each of the pullout members **170** to **173** can be moved independently of each other between an inside position for the main body of the image forming apparatus **400** and an outside position for the main body of the image forming apparatus **400**. The pullout members **170** to **173** are configured so that the cartridges PY, PM, PC, and PK can be mounted and removed in a state in which the pullout members **170** to **173** are located in the outside position for the main body of the image forming apparatus **400**.

Pullout units U**5** to U**8**, in which the cartridges PY, PM, PC, and PK are respectively mounted in mounting portions of the pullout members **170** to **173**, are configured to be movable between the inside position and the outside position for the main body of the image forming apparatus **400**.

Specifically, as illustrated in FIG. **12**, the pullout unit U**5**, in which the cartridge PK for black K is mounted in the mounting portion of the pullout member **170**, is provided. The pullout unit U**6**, in which the cartridge PC for cyan C is mounted in the mounting portion of the pullout member **171**, is provided. The pullout unit U**7**, in which the cartridge PM for magenta M is mounted in the mounting portion of the pullout member **172**, is provided. The pullout unit U**8**, in which the cartridge PY for yellow Y is mounted in the mounting portion of the pullout member **173**, is provided.

The pullout units U**5** to U**8** are configured to be mounted into and pulled out of the main body of the image forming apparatus **400** independently. A configuration of each of the cartridges P and a configuration of mounting the cartridges P respectively into the mounting portions of the pullout members **170** to **173** are the same as those of the first embodiment. Therefore, the overlapping description thereof is herein omitted.

FIG. **12** is a perspective view for illustrating a state in which the pullout units U**5** to U**8** of this reference example are being mounted into the main body of the image forming apparatus **400** or being pulled out of the main body of the image forming apparatus **400**. As illustrated in FIG. **12**, the pullout unit U**5**, in which the cartridge PK for black K is mounted in the mounting portion of the pullout member **170**, is as follows.

The pullout unit U**5** includes guided portions **170***a* and **170***b*. The guided portions **170***a* and **170***b*, which are flange portions formed on the pullout member **170**, are as follows. The guided portions **170***a* and **170***b* are fitted into a guiding portion **180**R of a guiding member **180** and an unshown guiding portion of a guiding member **181** so as to be mounted in a direction indicated by the arrow D**1** in FIG. **12** along the guiding portions. The guiding members **180** and **181** are provided on the main body of the image forming apparatus **400**. Each of the guiding portions is a concave portion having a U-like cross section. Alternatively, the guided portions **170***a* and **170***b* can also be pulled out in a direction indicated by the arrow D**2**.

Even in the reference example, the intermediate transfer unit **5** is moved up from the image forming position to retract in conjunction with the operation of opening the door **10** which is provided on the main body of the image forming apparatus **400** so as to be openable and closable, as in the first embodiment described above. Therefore, during the operation of mounting or pulling out the pullout unit U**5**, the surface of the corresponding photosensitive drum **1** and the outer circumferential surface of the intermediate transfer unit **5** do not slide against each other.

Similarly, the pullout unit U**6** is as follows. The pullout unit U**6** includes guided portions **171***a* and **171***b*. The guided portions **171***a* and **171***b*, which are flange portions formed on the pullout member **171**, are as follows. The guided portions **171***a* and **171***b* are fitted into an unshown guiding portion of the guiding member **181** and an unshown guiding portion of a guiding member **182** so as to be mounted in the direction indicated by the arrow D**1** in FIG. **12** along the guiding portions. The guiding members unshown are provided on the main body of the image forming apparatus **400**. Each of the guiding portions is a concave portion having a U-like cross section. Alternatively, the guided portions **171***a* and **171***b* can also be pulled out in the direction indicated by the arrow D**2**. In FIG. **12**, the guiding portions **181**R and **182**L are located invisibly.

Similarly, the pullout unit U**7** is as follows. The pullout unit U**7** includes guided portions **172***a* and **172***b*. The guided portions **172***a* and **172***b*, which are flange portions formed on the pullout member **172**, are as follows. The guided portions **172***a* and **172***b* are fitted into an unshown guiding portion of the guiding member **182** and an unshown guiding portion of a guiding member **183** so as to be mounted in the direction indicated by the arrow D**1** in FIG. **12** along the guiding portions. The guiding members **182** and **183** are provided on the main body of the image forming apparatus **400**. Each of the guiding portions is a concave portion having a U-like cross section. Alternatively, the guided portions **172***a* and **172***b* can also be pulled out in the direction indicated by the arrow D**2**.

Similarly, the pullout unit U**8** is as follows. The pullout unit U**8** includes guided portions **173***a* and **173***b*. The guided portions **173***a* and **173***b*, which are flange portions formed on the pullout member **173**, are as follows. The guided portions **173***a* and **173***b* are fitted into an unshown guiding portion of the guiding member **183** and a guiding portion **184**L of a guiding member **184** so as to be mounted in the

direction indicated by the arrow D1 in FIG. **12** along the guiding portions. The guiding members **183** and **184** are provided on the main body of the image forming apparatus **400**. Each of the guiding portions is a concave portion having a U-like cross section. Alternatively, the guided portions **173***a* and **173***b* can also be pulled out in the direction indicated by the arrow D2.

According to this reference configuration, when the cartridge P of a certain color is to be replaced, all the cartridges P mounted independently in the mounting portions of the pullout members **170** to **173** are not required to be pulled out of the main body of the image forming apparatus **400**. Therefore, excellent convenience is provided.

On the other hand, however, the number of movable support members (pullout members **170** to **173**) is disadvantageously increased in this reference configuration. Specifically, each of the support members supports only one cartridge in this reference configuration. Thus, the number of support members becomes four so as to correspond to the number of cartridges.

Therefore, in comparison with the first embodiment and the second embodiment, the configuration of the image forming apparatus becomes relatively complex. For keeping user's convenience while reducing the complexity of the image forming apparatus, the configurations of the first embodiment and the second embodiment, each including the pullout member for supporting the plurality of cartridges, are preferred.

The reference configuration includes the pullout unit U5, in which the cartridge PK for black K is mounted in the mounting portion of the pullout member **170**. The reference configuration further includes the pullout unit U6, in which the cartridge PC for cyan C is mounted in the mounting portion of the pullout member **171**. The reference configuration further includes the pullout unit U7, in which the cartridge PM for magenta M is mounted in the mounting portion of the pullout member **172**.

The reference configuration further includes the pullout unit U8, in which the cartridge PY for yellow Y is mounted in the mounting portion of the pullout member **173**. There has been described the example of the configuration in which the pullout units U5 to U8 can be independently mounted into or pulled out of the main body of the image forming apparatus **400**. Besides, various other orders of arrangement of the colors can be used, and therefore the order of arrangement of the colors is not limited to that described in this reference example. The remaining configuration is the same as that of each of the embodiments described above, and the same effects can be obtained.

Third Embodiment

Next, a configuration of an image forming apparatus according to a third embodiment of the present invention will be described referring to FIGS. **13** to **19**. Components or members configured similarly to those in each of the embodiments described above are denoted by the same reference symbols or are denoted by the same names even though different reference symbols are given, and the description thereof is herein omitted.

In the first embodiment described above, the pullout unit U1, in which the cartridge PK for black K is mounted in the mounting portion **130***f* of the pullout member **130**, is independently mounted into the main body of the image forming apparatus **100**. Alternatively, there has been described the example of the configuration in which the pullout unit U1 can be pulled out of the main body of the image forming apparatus **100**. Further, in each of the embodiments described above, the support members (support members, support units) for supporting the respective cartridges P are moved in the direction parallel to the axial direction of the photosensitive drums **1**.

In the embodiment, an image forming apparatus **500** includes a pullout member **200**, which is a support member for supporting the cartridge PK for forming an image in black K, as illustrated in FIGS. **13** and **14**.

The image forming apparatus **500** further includes the cartridge PY for forming an image in yellow Y, the cartridge PM for forming an image in magenta M, and the cartridge PC for forming an image in cyan C, which are the plurality of colors different from black K. The image forming apparatus **500** includes a pullout member **201**, which is a support member for supporting the cartridges PY, PM, and PC.

The pullout members **200** and **201** of the embodiment are moved in a direction orthogonal to the axial direction of the photosensitive drums **1** (crosswise direction in FIGS. **13** and **14**). The pullout members **200** and **201** are configured to be pulled out from an inside position for a main body of the image forming apparatus **500** to an outside position for the main body of the image forming apparatus **500**, at which the cartridges P can be mounted and removed, through the opening portion **16** formed in the main body of the image forming apparatus **500**.

In the embodiment, as illustrated in FIG. **13**, the pullout member **200** is supported so as to be movable in a direction indicated by the arrow D1 in FIG. **13**, which is a pullout direction for the pullout member **201**. The pullout member **200** is provided on a most downstream side (right side in FIG. **13**) in the direction indicated by the arrow D1 in FIG. **13**, which is the pullout direction.

In the embodiment, the pullout members **200** and **201** are movable with respect to the main body of the image forming apparatus **500** (main body). A pullout unit T1, in which the cartridge PK for black K is mounted in a mounting portion **200***f* of the pullout member **200**, is provided on the most downstream side in the pullout direction indicated by the arrow D1 in FIGS. **13** and **14**. A configuration of the main body of the image forming apparatus **500** and a configuration of each of the cartridges P are the same as those of the first embodiment described above, and therefore the overlapping description thereof is herein omitted.

<Support Members>

Next, configurations of the pullout members **200** and **201**, which are provided on the main body of the image forming apparatus **500** of the embodiment so that the pullout members **200** and **201** can be mounted into and pulled out of the main body of the image forming apparatus **500**, are described referring to FIGS. **13** and **14**. FIG. **13** is a sectional explanatory view for illustrating a state in which the pullout unit T1 of the third embodiment is being mounted into or pulled out of the main body of the image forming apparatus **500**. FIG. **14** is a sectional explanatory view for illustrating a state in which the pullout units T1 and T2 of the third embodiment are being mounted into or pulled out of the main body of the image forming apparatus **500**.

As illustrated in FIGS. **13** and **14**, the pullout members **200** and **201** are provided so as to be movable (pressed or pulled out) linearly substantially in the horizontal direction indicated by the arrows D1 and D2 in FIGS. **13** and **14** with respect to the main body of the image forming apparatus **500**. The pullout members **200** and **201** can be moved to the inside position for the main body of the image forming apparatus **500** or to the outside position for the main body of the image forming apparatus **500**.

As illustrated in FIG. **14**, the pullout member **200** is located in the outside position for the main body of the image forming apparatus **500**. In this state, the cartridge PK for black K is mounted by the user into the mounting portion **200***f* of the pullout member **200** substantially in the gravity direction indicated by the arrow B in FIG. **14**.

Similarly, as illustrated in FIG. **14**, the pullout member **201** is located in the outside position for the main body of the image forming apparatus **500**. In this state, the cartridges PY, PM, and PC for the other colors are mounted by the user into an unshown mounting portion of the pullout member **201** in the gravity direction indicated by the arrow B in FIG. **14**.

The cartridges P mounted as described above are arranged so that a longitudinal direction thereof (axial direction of the photosensitive drums **1**) becomes a direction orthogonal to a moving direction of the pullout members **200** and **201**. The four cartridges PY, PM, PC, and PK are arranged side by side so that the longitudinal direction thereof is oriented in the direction orthogonal to the moving direction of the pullout members **200** and **201**.

The cartridges P are moved into the main body of the image forming apparatus **500** together with the pullout members **200** and **201** in a state in which the cartridges P are mounted into the mounting portion **200***f* of the pullout member **200** and the mounting portion **201***f* of the pullout member **201**.

Then, the pullout members **200** and **201** are moved into the main body of the image forming apparatus **500**. In this state, a door **110**, which is provided on the main body of the image forming apparatus **500** so as to be openable and closable, is closed. Then, all the cartridges P are positioned at predetermined positions inside the main body of the image forming apparatus **500**.

In the embodiment, when the pullout member **200** is located in the inside position (position inside of the main body), the pullout member **200** is located on a movement path of the pullout member **201**. Specifically, in the embodiment, the two pullout members **200** and **201** share the same movement path. The two pullout members **200** and **201** are pulled out of the main body of the image forming apparatus **500** through the same opening portion **16**.

With a configuration in which the movement path is shared by the pullout members **200** and **201**, the configuration of the image forming apparatus **500** can be prevented from becoming complex or increasing in size even when the image forming apparatus **500** includes a plurality of pullout members.

In the first embodiment and the second embodiment, each of the pullout members is moved along the axis (longitudinal direction) of the photosensitive drums **1**. Therefore, different movement paths are required to be provided to the respective pullout members. In the third embodiment, however, the pullout members **200** and **201** are moved in the direction orthogonal to the axis (longitudinal direction) of the photosensitive drums **1**. Therefore, the movement path can be shared by the pullout members **200** and **201**.

According to the embodiment, however, when the pullout member **201** is moved to the outside position (position outside of the main body), the pullout member **200** is also required to be moved to the outside position (see FIG. **14**).

Therefore, the pullout member **200** that supports the highly frequently used (highly frequently replaced) cartridge PK for black K is preferred to be located on the downstream side of the pullout member **201** in the pullout direction (direction indicated by the arrow D1). This configuration is provided so as to allow the pullout member **200** to be independently moved between the outside position and the inside position in a state in which the pullout member **201** remains in the inside position.

<Mounting Portion for Support Members>

Next, a configuration of the mounting portion **7** of the main body of the image forming apparatus **500** for the pullout members **200** and **201** will be described referring to FIGS. **15** to **17**. FIG. **15** is a perspective view for illustrating the configuration of the mounting portion **7** of the main body of the image forming apparatus **500** for the pullout members **200** and **201** according to the embodiment. In FIG. **15**, the intermediate transfer unit **5** is omitted from the members (components) constructing the main body of the image forming apparatus **500** for easy understanding of the configuration of the mounting portion **7**.

As illustrated in FIGS. **16** and **17**, the pullout member **200** of the embodiment is coupled movably to the pullout member **201** so as to be mounted into the main body of the image forming apparatus **500** integrally. As illustrated in FIG. **15**, a pair of guiding portions **203**R and **203**L is formed on inner wall surfaces of the main body of the image forming apparatus **500**. The guiding portions **203**R and **203**L, each of which is a concave portion having a U-like cross section, guide the pullout member **201** in the moving direction and are formed so as to be opposed to each other.

Guided portions **201***a* and **201***b* illustrated in FIGS. **16** and **17**, each having a columnar shape, are slidably fitted into the guiding portions **203**R and **203**L. The guided portions **201***a* and **201***b* are formed on side walls of the pullout member **201** so as to project therefrom. Further, guided portions **201***c* and **201***d*, which are both longitudinal ends of a flange portion **201***e* formed on a far end portion of the pullout member **201**, are slidably fitted into the guiding portions **203**R and **203**L.

The guiding portions **203**R and **203**L, which are the concave portions each having the U-like cross section, illustrated in FIG. **15**, can guide the pullout member **201** illustrated in FIGS. **16** and **17** from the outside position for the main body of the image forming apparatus **500** to the inside position for the main body of the image forming apparatus **500**. The guiding portions **203**R and **203**L are formed so as to extend in substantially the horizontal direction from the vicinity of the door **110** (vicinity of the inlet) to the far side of the main body of the image forming apparatus (left side in FIG. **15**). The door **110** is provided on the main body of the image forming apparatus **500** so as to be openable and closable.

Further, as illustrated in FIG. **15**, the development coupling members **26** for transferring the rotational driving force to the developing rollers **40** are provided below the guiding portion **203**R. Further, below the development coupling members **26**, the drum coupling members **25** for transferring the rotational driving force to the photosensitive drums **1** are provided. The drum coupling members **25** are provided at equal intervals in the horizontal direction so as to correspond to the four cartridges PY, PM, PC, and PK. Similarly, the development coupling members **26** are provided at equal intervals in the horizontal direction so as to correspond to the four cartridges PY, PM, PC, and PK.

The drum coupling members **25** and the development coupling members **26** illustrated in FIG. **15** are subject to the rotational driving force from the motor, which is a driving source (not shown) provided on the main body of the image forming apparatus **500**. The drum coupling members **25** and the development coupling members **26** transfer the rota-

tional driving force to the photosensitive drums **1** and the developing rollers **40** rotatably provided on the respective cartridges P.

The drum coupling members **25** and the development coupling members **26** are in a retracted state inside the side walls of the main body of the image forming apparatus **500** in a state in which the door **110** illustrated in FIG. **15** is opened. In conjunction with the operation of closing the door **110**, the drum coupling members **25** and the development coupling members **26**, which are retracted inside the side walls of the main body of the image forming apparatus **500**, project. Then, the drum coupling members **25** and the development coupling members **26** move toward first coupling members **470** and second coupling members **450** provided on the cartridges P illustrated in FIG. **17** to be engaged therewith.

In this manner, the rotational driving force from the motor, which is the driving source (not shown) provided on the main body of the image forming apparatus **500**, is transferred to the drum coupling members **25** and the development coupling members **26**. Then, the rotational driving force is transferred to the developing rollers **40** and the photosensitive drums **1** respectively through the first coupling members **470** and the second coupling members **450**. In this manner, the developing rollers **40** and the photosensitive drums **1** are rotationally driven.

<Support Members>

Next, a configuration of each of the pullout members **200** and **201** according to the embodiment will be described referring to FIGS. **13** to **17**. FIG. **16** is a perspective view for illustrating the configurations of the pullout members **200** and **201** that are provided so that the pullout members **200** and **201** can be mounted into and pulled out of the main body of the image forming apparatus **500** of the embodiment. FIG. **17** is a perspective view of the pullout members **200** and **201** illustrated in FIG. **16** as viewed from the opposite side.

As illustrated in FIGS. **16** and **17**, the guided portions **201***a* to **201***d* are formed on four corners of the pullout member **201**. The guided portions **201***a* to **201***d* are guided by the guiding portions **203**R and **203**L, which are formed on the inner wall surfaces of the main body of the image forming apparatus **500** and are concave portions each having a U-like cross section as shown in FIG. **15**.

Each of the guided portions **201***a* and **201***b* illustrated in FIGS. **16** and **17** is formed to have a columnar shape that projects outward from the side wall of the pullout member **201**. The guided portions **201***c* and **201***d* are formed on the far side of the main body of the image forming apparatus **500**. The guided portions **201***c* and **201***d* are both longitudinal ends of the flange portion **201***e* that projects outward from the side wall of the pullout member **201**.

The guided portions **201***a* and **201***c*, which project outward from one of the side walls of the pullout member **201** as illustrated in FIG. **17**, are slidably fitted into the guiding portion **203**R formed on the right wall surface of the main body of the image forming apparatus **500** illustrated in FIG. **15** so as to be guided.

The guided portions **201***b* and **201***d*, which project outward from another side wall of the pullout member **201** as illustrated in FIG. **16**, are slidably fitted into the guiding portion **203**L formed on the left wall surface of the main body of the image forming apparatus **500** illustrated in FIG. **15** so as to be guided.

The flange portion **201***e* is formed on the pullout member **201** illustrated in FIGS. **16** and **17** on the far side of the main body of the image forming apparatus **500**. The guided portions **201***c* and **201***d* are formed on both longitudinal ends of the flange portion **201***e* so as to extend in the pullout direction of the pullout member **201** (crosswise direction in FIG. **14**), as illustrated in FIG. **14**.

The guided portions **201***c* and **201***d* of the pullout member **201** are slidably fitted respectively into the guiding portions **203**R and **203**L formed on the inner wall surfaces of the main body of the image forming apparatus **500** on both sides. In this manner, the pullout member **201** is configured so as not to be inclined in a state in which the pullout member **201** is pulled out of the main body of the image forming apparatus **500**.

As illustrated in FIGS. **13** and **14**, the pullout unit T**1**, in which the cartridge PK for black K is mounted in the mounting portion **200***f* of the pullout member **200**, is as follows in the embodiment. The pullout member T**1** is provided so that the pullout member T**1** can be mounted and pulled out with respect to the pullout unit T**2**, in which the cartridges PY, PM, and PC for the other colors are mounted in the mounting portion **201***f* of the pullout member **201**.

As illustrated in FIG. **17**, guiding portions **202***a* and **202***b* for guiding the mounting of the pullout member **200** are formed on inner wall surfaces of the pullout member **201**. The guiding portions **202***a* and **202***b* are concave portions each having a U-like cross section. On the other hand, guided portions including guided portion **200***a* are formed on outer wall surfaces of the pullout member **200** so as to project therefrom. The guided portions are slidably fitted into the guiding portions **202***a* and **202***b*.

As illustrated in FIG. **16**, the following is provided on the outer wall surface of the pullout member **200**, which is located on the opening side of the main body of the image forming apparatus **500**. Specifically, grip portions **211** and **210** are provided. The grip portion **211** allows the user to operate the pullout unit T**1** alone, whereas the grip portion **210** allows the user to operate the pullout members T**1** and T**2** together.

As illustrated in FIG. **17**, the mounting portion **200***f* for mounting the cartridge PK for black K is formed in the pullout member **200**. Further, the mounting portion **201***f* for mounting the cartridges P for the other colors is formed in the pullout member **201**. The mounting portions **200***f* and **201***f* are provided in one row along the directions indicated by the arrows D**1** and D**2** in FIGS. **16** and **17** that are the pullout direction and the mounting direction of the pullout units T**1** and T**2**. In FIGS. **16** and **17**, the mounting portion **201***f* is located invisibly.

As illustrated in FIGS. **16** and **17**, the following is provided to both longitudinal ends of the mounting portion **200***f* of the pullout member **200**. Specifically, guiding portions **200***h* to **200***k* are formed so that the cartridge PK for black K is mounted in the mounting portion **200***f* of the pullout member **200**. The guiding portions **200***h* to **200***k* are concave portions each having a U-like cross section. Each of the guiding portions **200***h* to **200***k* extends in a vertical direction indicated by the arrow B in FIGS. **16** and **17**.

A positioning portion **200***p* is formed on the guiding portion **200***h* and a positioning portion **200***q* is formed on the guiding portion **200***k* as illustrated in FIGS. **16** and **17**. The positioning portions **200***p* and **200***q* are U-shaped grooves for positioning the cartridge PK for black K with respect to the pullout member **200**. Positioned portions **80***d* and **80***e*, which are formed on both longitudinal ends of the cartridge PK for black K so as to project therefrom, are fitted into the positioning portions **200***p* and **200***q*. In this manner, the both longitudinal ends of the cartridge PK for black K are positioned.

As illustrated in FIG. **17**, an outer circumference of the second coupling member **450** provided on a longitudinal end of each of the cartridges P is covered with a cylindrical rib to form the positioned portion **80***d*. Further, as illustrated in FIG. **16**, the guided portion **80***e*, which is formed as a cylindrical projection, is formed on a longitudinal end of each of the cartridges P, which is on the side opposite to the side where the positioned portion **80***d* is formed.

Further, as illustrated in FIG. **17**, a rotation regulated portion **80***f* having an oval cross section, which determines an attitude of each of the cartridges P, is formed. Further, as illustrated in FIG. **16**, a rotation regulated portion **80***g* having an oval cross section, is formed on a longitudinal end of each of the cartridges P, which is on the side opposite to the side where the rotation regulated portion **80***f* is formed.

As illustrated in FIGS. **16** and **17**, the rotation regulated portions **80***f* and **80***g* respectively formed on the longitudinal ends of each of the cartridges P are formed to have a columnar shape with an oval cross section that is elongated in the direction indicated by the arrow B in FIGS. **16** and **17**. The positioned portions **80***d* and **80***e* and the rotation regulated portions **80***f* and **80***g*, which are formed on the longitudinal ends of each of the cartridges P, have a function of positioning the cartridges P in the mounting portion **200***f* of the pullout member **200** and the mounting portion **201***f* of the pullout member **201**.

The pullout member **200**, in which the cartridge PK for black K is mounted in the mounting portion **200***f*, is configured as the pullout unit T**1**. Then, the pullout member **200** can be pulled out independently as illustrated in FIG. **13** or integrally with the pullout member **201** as illustrated in FIG. **14** to the outside position for the main body of the image forming apparatus **500**.

Further, the pullout member **201**, in which the cartridges P for the other colors are mounted in the mounting portion **201***f*, can be similarly pulled out integrally with the pullout member **200** to the outside position for the main body of the image forming apparatus **500**, as illustrated in FIG. **14**, as the pullout unit U**2**.

When the user grips and operates the grip portion **211** illustrated in FIG. **16**, regulating members **200***o*R and **200***o*L provided on both longitudinal ends of the pullout member **200** are disengaged.

<Coupling Portion for Support Members>

Next, a configuration of a coupling portion for the pullout member **200** and the pullout member **201** will be described referring to FIGS. **18** and **19**. FIG. **18** is a perspective view for illustrating a configuration when the pullout units T**1** and T**2** are coupled to each other in the image forming apparatus **500** according to the third embodiment. FIG. **19** is a perspective view for illustrating a configuration when the coupling between the pullout units T**1** and T**2** is released in the image forming apparatus **500** according to the third embodiment.

For convenience of the description of the coupling portion between the pullout members **200** and **201**, the grip portions **210** and **211** illustrated in FIG. **16** and a frame for the pullout member **200** are omitted in FIGS. **18** and **19**.

As illustrated in FIG. **18**, the pullout members **200** and **201** are coupled to each other as follows. A concave portion **200***u*R of the regulating member **200***o*R and a concave portion **200***u*L of the regulating member **200***o*L, which are provided on the pullout member **200**, are respectively fitted to and brought into abutment against regulating portions formed on inner wall surfaces of the pullout member **201** so as to project therefrom. The regulating members **200***o*R and **200***o*L are constantly biased by biasing members (not shown) respectively in a direction indicated by the arrow E and a direction indicated by the arrow N in FIG. **18**.

A link member **200***r* provided integrally with the grip portion **211** illustrated in FIG. **16** provided on the pullout member **200** is constantly biased by biasing members **200***t*R and **200***t*L in a direction indicated by the arrow O in FIG. **18**.

As illustrated in FIG. **19**, the coupling between the pullout members **200** and **201** is released as follows. Through a user's operation of pulling the link member **200***r* provided integrally with the grip portion **211** illustrated in FIG. **16** toward the user, the link member **200***r* rotates in a direction indicated by the arrow G in FIG. **19**.

In conjunction with the operation described above, the regulating member **200***o*R rotates in a direction indicated by the arrow F in FIG. **19**, whereas the regulating member **200***o*L rotates in a direction indicated by the arrow Q in FIG. **19**. At this time, the fitting-abutment between each of the concave portion **200***u*R of the regulating member **200***o*R and the concave portion **200***u*L of the regulating member **200***o*L and each of the regulating portions **201***o*R and **201***o*L, which are formed on the inner wall surfaces of the pullout member **201** so as to project therefrom, is released. Then, as illustrated in FIG. **13**, the pullout unit T**1** can be separated from the pullout unit T**2** to be pulled out.

In this manner, the pullout unit T**1** alone can be pulled out independently to the outside position for the main body of the image forming apparatus **500** while the pullout unit T**2** is left in the inside position for the main body of the image forming apparatus **500**, as illustrated in FIG. **13**.

On the other hand, when the user grips and operates the grip portion **210** illustrated in FIG. **16**, the regulating members **200***o*R and **200***o*L provided on the both longitudinal ends of the pullout member **200** are not disengaged. Then, the pullout units T**1** and T**2** can be pulled out integrally to the outside position for the main body of the image forming apparatus **500**.

Similarly to the first embodiment described above, the door **110**, which is provided on the main body of the image forming apparatus **500** so as to be openable and closable, is opened in the embodiment. In conjunction with the operation, the intermediate transfer unit **5** illustrated in FIGS. **13** and **14** is moved down in FIGS. **13** and **14** by the moving unit (not shown) so as to be retracted from the image forming position.

Therefore, at the time of the operation of mounting and pulling out the pullout units T**1** and T**2**, the surfaces of the photosensitive drums **1** and the outer circumferential surface of the intermediate transfer belt **11** of the intermediate transfer unit **5** do not slide against each other.

According to the embodiment, the cartridge PK for black L alone can be mounted at the inside position for the main body of the image forming apparatus **500** or pulled out to the outside position for the main body of the image forming apparatus **500**. Therefore, the four cartridges P are not required to be pulled out together. Thus, only the cartridge PK for black K, which is highly frequently used, can be replaced.

Therefore, in contrast to the configuration in which the four cartridges P are pulled out together, excellent workability in replacement is provided in a case where the capacity of each of the cartridges P is increased to increase the weight. Further, by arranging the cartridge PK for black K on the downstream side in the pullout direction for the pullout units T**1** and T**2**, excellent convenience is provided when the cartridge PK for black K, which is highly frequently used, is replaced.

In the embodiment, there has been described the example where the pullout unit T1, in which the cartridge PK for black K is mounted in the mounting portion **200***f* of the pullout member **200**, is mounted in the main body of the image forming apparatus **500**. Besides, the cartridge to be mounted in the mounting portion **200***f* of the pullout member **200** is not limited to the cartridge PK for black K. The cartridge P for another color may be mounted in the mounting portion **200***f* of the pullout member **200**.

Further, in the embodiment, there has been described the example of the configuration in which the scanner unit **3** is provided in the main body of the image forming apparatus **500** so that the light beams are radiated from above the photosensitive drums **1** for light exposure. Besides, the scanner unit **3** may be provided in the main body of the image forming apparatus **500** so that the light beams are radiated from below the photosensitive drums **1** for light exposure.

Further, in the embodiment, there has been described the example of the intermediate transfer member as an example of the intermediate transfer unit **5**. Besides, the present invention may be applied to such a direct transfer method that the sheet S, which is a transferred material, is conveyed to the transfer portion in which the surface of the photosensitive drum **1** and the transfer unit are opposed to each other so that the toner image formed on the surface of the photosensitive drum **1** is directly transferred onto the sheet S. The remaining configuration is the same as that of each of the embodiments described above, and the same effects can be obtained.

Fourth Embodiment

Next, a configuration of an image forming apparatus according to a fourth embodiment of the present invention will be described referring to FIG. **20**. Components or members configured similarly to those in each of the embodiments described above are denoted by the same reference symbols or are denoted by the same names even though different reference symbols are given, and the description thereof is herein omitted.

In the first embodiment described above, there has been described the example where the pullout unit U1, in which the cartridge PK for black K is mounted in the mounting portion **130***f* of the pullout member **130**, is mounted into the main body of the image forming apparatus **100**. Further, there has been described the example where each of the cartridges P is a process cartridge in which the photosensitive drum **1** is provided integrally.

In the fourth embodiment, as illustrated in FIG. **20**, the photosensitive drums **1** serving as the photosensitive members on which the electrostatic latent images are formed are provided integrally in pullout members **601** and **602** serving as support members. Specifically, the photosensitive drums **1** are fixed to the pullout members **601** and **602**.

A developing cartridge **603**Y for containing a developer for yellow Y, a development cartridge **603**M for containing a developer for magenta M, a developing cartridge **603**C for containing a developer for cyan C, and a developing cartridge **603**K for containing a developer for black K are configured to be mountable into and removable from the pullout members **601** and **602**. Each of the developing cartridges **603** has a developing roller for developing the latent image.

A configuration of a main body of an image forming apparatus **600**, a configuration of each of the developing cartridges **603**, and configurations of the pullout members **601** and **602** of the embodiment are as follows. The configurations are substantially the same as those of the first embodiment described above except that each of the photosensitive drums **1** and the pullout members **601** and **602** are formed integrally. Therefore, the overlapping description thereof is herein omitted.

For example, the plurality of developing cartridges **603**, which can be mounted into and removed from the main body of the image forming apparatus **600**, include the developing cartridge **603**K that is used in an image forming portion for black K. The image forming apparatus **600** includes the pullout member **601** serving as the support member that supports the developing cartridge **603**K and the photosensitive drum **1** on which the electrostatic latent image is formed so as to correspond to the developing cartridge **603**K. The developing cartridge **603**K is mountable into and removable from the pullout member **601**.

The image forming apparatus **600** further includes the plurality of developing cartridges **603**Y, **603**M, and **603**C for forming images in colors (yellow, cyan, and magenta) different from black. The image forming apparatus **600** further includes the pullout member **602** serving as the support member that supports the developing cartridges **603**Y, **603**M, and **603**C and the plurality of photosensitive drums **1** on which the electrostatic latent images are formed so as to correspond to the developing cartridges. Each of the developing cartridges **603**Y, **603**M, and **603**C is mountable into and removable from the pullout member **602**.

Each of the pullout members **601** and **602** is moved in the direction parallel to the axial direction of the photosensitive drums **1**. Then, each of the pullout members **601** and **602** can be configured to be pulled out from the inside position for the main body of the image forming apparatus **600** to the outside position for the main body of the image forming apparatus **600**, at which the developing cartridges **603** can be mounted and removed, through the opening portion **16** formed in the main body of the image forming apparatus **600**.

Each of the pullout members (support members) **601** and **602** is moved in the direction parallel to the axial direction of the photosensitive drums **1**. The pullout members **601** and **602** can also be configured to be pulled out from the inside position for the main body of the image forming apparatus **600** to the outside position for the main body of the image forming apparatus **600**, at which the development cartridges **603** can be mounted and removed, through the opening portion **16** formed in the main body of the image forming apparatus **600**.

The pullout members **601** and **602** can be moved independently between the inside position for the main body of the image forming apparatus **600** and the outside position for the main body of the image forming apparatus **600**. The developing cartridges **603** can be mounted and removed in a state in which the pullout members **601** and **602** are located in the outside position for the main body of the image forming apparatus **600**.

In the embodiment, there has been described the example of the configuration in which the scanner unit **3** is provided in the main body of the image forming apparatus **600** so that the light beams are radiated from above each of the photosensitive drums **1** for light exposure. Besides, the scanner unit **3** may be provided in the main body of the image forming apparatus **600** so that the light beams are radiated from below the photosensitive drums **1** for light exposure.

According to the embodiment, when the developing cartridge **603**K for black K, which is highly frequently used, is to be replaced, the developing cartridges **603** mounted in the

pullout members **601** and **602** are not all required to be pulled out of the main body of the image forming apparatus **600**. Therefore, excellent convenience is provided.

Finally, the effects of the embodiments described above are summarized as follows. According to each of the embodiments described above, usability when the user pulls out each of the support members to the outside position for the main body of the image forming apparatus can be improved with the simple configuration.

While the present invention has been described with reference to exemplary embodiments, it is to be understood that the invention is not limited to the disclosed exemplary embodiments. The scope of the following claims is to be accorded the broadest interpretation so as to encompass all such modifications and equivalent structures and functions.

This application claims the benefit of Japanese Patent Application No. 2014-110758, filed May 29, 2014, and Japanese Patent Application No. 2015-086632, filed Apr. 21, 2015, which are hereby incorporated by reference herein in their entirety.

What is claimed is:

1. An image forming apparatus, comprising:

a plurality of image forming portions configured to form images of colors different from one another;

a first support member movable with respect to a main body of the image forming apparatus in a state in which the first support member supports a plurality of cartridges; and

a second support member movable with respect to the main body independently of the first support member in a state in which the second support member supports a cartridge different from the plurality of cartridges supported by the first support member,

wherein the plurality of cartridges supported by the first support member and the cartridge supported by the second support member are used in the plurality of image forming portions different from one another, respectively,

each of the first support member and the second support member is movable between an inside position located inside of the main body and an outside position located outside of the main body,

the second support member is located on a movement locus of the first support member when the second support member is located in the inside position, and

each of the plurality of cartridges supported by the first support member and the cartridge supported by the second support member is removably mountable in a state in which the first support member and the second support member are located in the outside position.

2. An image forming apparatus according to claim **1**, wherein the second support member is located on a downstream side of the first support member in a moving direction in which the first support member is moved from the inside position to the outside position.

3. An image forming apparatus according to claim **1**, wherein the second support member is moved to the outside position to move the first support member to the outside position.

4. An image forming apparatus according to claim **1**, wherein the image forming apparatus is operable in a monochrome mode in which the image is formed only by one of the plurality of image forming portions, and

the cartridge supported by the second support member is used in the one of the plurality of image forming portions which forms the image in the monochrome mode.

5. An image forming apparatus according to claim **1**, wherein the cartridge supported by the second support member is used in one of the plurality of image forming portions which forms an image in black.

6. An image forming apparatus according to claim **1**, wherein the plurality of cartridges supported by the first support member are used in the plurality of image forming portions which form an image in yellow, an image in magenta, and an image in cyan, respectively.

7. An image forming apparatus according to claim **1**, wherein only one cartridge is supported by the second support member.

8. An image forming apparatus according to claim **1**, wherein the second support member supports a plurality of cartridges; and

a number of the plurality of cartridges supported by the second support member is equal to or smaller than a number of the plurality of cartridges supported by the first support member.

9. An image forming apparatus according to claim **1**, wherein each of the plurality of cartridges supported by the first support member and the cartridge supported by the second support member comprises an image bearing member configured to bear an image.

10. An image forming apparatus according to claim **1**, wherein each of the plurality of cartridges supported by the first support member and the cartridge supported by the second support member comprises a developer carrying member configured to develop a latent image.

11. An image forming apparatus according to claim **1**, wherein the plurality of cartridges supported by the first support member and the cartridge supported by the second support member contain developers of colors different from one another, respectively.

12. An image forming apparatus, comprising:

a plurality of image forming portions configured to form images of colors different from one another, each of the plurality of image forming portions comprising an image bearing member configured to bear an image;

a first support member movable with respect to a main body of the image forming apparatus in a state in which the first support member supports a cartridge; and

a second support member movable with respect to the main body independently of the first support member in a state in which the second support member supports a cartridge different from the cartridge supported by the first support member,

wherein the cartridge supported by the first support member and the cartridge supported by the second support member are used in the plurality of image forming portions different from one another, respectively,

each of the first support member and the second support member is movable between an inside position located inside of the main body and an outside position located outside of the main body along a direction orthogonal to a longitudinal direction of the image bearing member, and

each of the cartridge supported by the first support member and the cartridge supported by the second support member is removably mountable in a state in which the first support member and the second support member are located in the outside position.

13. An image forming apparatus according to claim **12**, wherein the second support member is located on a movement locus of the first support member when the second support member is located in the inside position.

14. An image forming apparatus according to claim 12, wherein the second support member is located on a downstream side of the first support member in a moving direction in which the first support member is moved from the inside position to the outside position.

15. An image forming apparatus according to claim 12, wherein the second support member is moved to the outside position to move the first support member to the outside position.

16. An image forming apparatus according to claim 12, wherein the first support member supports a plurality of cartridges.

17. An image forming apparatus, comprising:

a plurality of image forming portions configured to form images of colors different from one another;

a first support member movable with respect to a main body of the image forming apparatus in a state in which the first support member supports a plurality of cartridges;

a second support member movable with respect to the main body independently of the first support member in a state in which the second support member supports a cartridge different from the plurality of cartridges supported by the first support member; and

a guiding member disposed between the first support member and the second support member,

wherein the plurality of cartridges supported by the first support member and the cartridge supported by the second support member are used in the plurality of image forming portions different from one another, respectively,

each of the first support member and the second support member is movable between an inside position located inside of the main body and an outside position located outside of the main body,

the plurality of cartridges supported by the first support member are removably mountable to the first support member in a state in which the first support member is located in the outside position and supported by the guiding member,

the cartridge supported by the second support member is removably mountable to the second support member in a state in which the second support member is located in the outside position and supported by the guiding member, and

the guiding member is provided with a first guiding portion guiding a movement of the first support member between the inside position and the outside position and a second guiding portion guiding a movement of the second support member between the inside position and the outside position.

18. An image forming apparatus according to claim 17, wherein each of the plurality of image forming portions comprises an image bearing member configured to bear an image, and

each of the first support member and the second support member is moved between the inside position and the outside position along a longitudinal direction of the image bearing member.

19. An image forming apparatus according to claim 17, wherein the cartridge supported by the second support member is used in one of the plurality of image forming portions which forms an image in black.

20. An image forming apparatus according to claim 17, wherein each of the plurality of cartridges supported by the first support member and the cartridge supported by the second support member comprises an image bearing member configured to bear an image or a developer carrying member configured to develop a latent image.

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